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NUCLEAR SCIENCE ABSTRACTS

Vol. 4 No. 9

Table of Contents for May 15, 1950.

Category	Abstract	Page
DOCUMENTS REFERENCE LIST		iii
GENERAL		395
Research Programs	2501	
BIOLOGY AND MEDICINE		395
Radiation Effects	2503	
Radiation Hazards and Protection	2524	
Radiation Sickness	2539	
Radiography	2544	
Radiotherapy	2546	
Toxicology Studies	2581	
Tracer Applications	2587	
CHEMISTRY		413
Analytical Procedures	2628	
Fluorine and Fluorocarbons	2640	
Laboratories and Equipment	2645	
Radiation Effects	2648	
Rare Earths and Rare Earth Compounds	2651	
Separation Procedures	2652	
Syntheses	2655	
Tracer Applications	2658	
Uranium and Uranium Compounds	2660	
ENGINEERING		417
Radiography	2665	
MINERALOGY, METALLURGY, AND CERAMICS		417
Ceramics and Refractories	2666	
Geology and Geophysics	2667	
Metals and Metallurgy	2669	
Minerals and Mineralogy	2678	
Tracer Applications	2679	
PHYSICS		419
Astrophysics	2689	
Cosmic Radiation and Mesons	2690	
Instruments	2707	
Isotopes	2715	
Isotopes Separation	2716	
Mass Spectrography	2721	
Mathematics	2729	
Measuring Instruments and Techniques	2730	
Meteorology	2750	
Molecular Structures	2751	
Neutrons	2754	
Nuclear Physics	2760	
Nuclear Properties	2762	
Nuclear Reactors	2768	

TABLE OF CONTENTS FOR MAY 15, 1950

Category	Abstract	Page
PHYSICS		
Nuclear Transformation	2769	
Particle Accelerators	2785	
Radiation Absorption and Scattering	2794	
Radioactivity	2805	
Theoretical Physics	2817	
Tracer Applications	2843	
AUTHOR INDEX		A
SUBJECT INDEX		E
NUCLIDE INDEX		P
FOREIGN GEOGRAPHIC INDEX		R
PUBLISHED DOCUMENTS INDEX		S
NNES ANNOUNCEMENT		U

ERRATA

In NSA 4-730, p. 121, Feb. 15, 1950, the report number MTT-RL-44 should read MIT-RL-44-2/26/45.

DOCUMENTS REFERENCE LIST

Vol. 4 No. 9

U. S. ATOMIC ENERGY COMMISSION DECLASSIFIED DOCUMENTS

Document	Title, Author	Abstract
AECD-2799	Relative Ionization in Various Gases by Alpha Particles from a Thick Uranium Source. H. H. Rossi.	2794
AECD-2807	Monte Carlo Methods for Shield Computation. G. Goertzel and H. Kahn.	2795
AECD-2808	A Proposed Particle Attentuation Problem. G. Goertzel.	2796
AECD-2810	Effect of Nuclear Reactor Radiation on Metals. D. S. Billington and S. Siegel.	2669

U. S. ATOMIC ENERGY COMMISSION UNCLASSIFIED DOCUMENTS

AECU-379	The Acute Radiation Syndrome. L. H. Hempelmann.	2539
AD-190(0)	Scene Photography with Film Fogged by Gamma Radiation. F. W. Brown, III.	2648
CAR-6	Progress Report for October, November, and December, 1949. R. Smoluchowski.	2670
COO-6	Melting and Refining of Relatively High Purity Nickel. V. F. Zackay and F. P. Kershaw.	2671
COO-8	An Inexpensive Automatic Dial Gauge Strain Recorder. C. D. Nail and E. R. Parker.	2707
GEZR-1	Development of Zirconium Base Alloys. R. W. Hennig and J. D. Nisbet.	2672
K-492	Statistical Applications of the Sample Range. O. S. Carpenter.	2729
KAPL-305	Determination of Zirconium in the Presence of Uranium; A Spectrophotometric Method. R. Guenther and R. H. Gale.	2660
NEPA-1306	The Effect of Molten Bismuth on Insulating Materials. W. S. Fleshman and C. G. Collins.	2666
NEPA-1324	High Energy Gamma Ray Penetration in Lead. W. E. White.	2805
NYOO-94	Determination of Uranium in Air Dust Samples by Alpha Counting Methods. J. H. Harley and E. Jetter.	2581
NYOO-99	Progress Report for October 1 through December 31, 1949. R. Levine, L. B. Barkley, M. W. Farrar, and J. K. Sneed.	2640
NYOO-1501	Calculation and Statistical Analysis of the Biochemical Oxygen Demand Velocity Constant. W. N. Grune.	2502
NYOO-1502	The Negation of Squid Embryo Tropisms by X-radiation. R. Rugh.	2503
ORNL-377	The Preparation of Uridylic and Cytidylic Acids from Yeast Ribonucleic Acid by an Ion-Exchange Method. W. E. Cohn and C. E. Carter	2652
ORNL-390	Activation Analysis of the Rare Earths. H. W. Kohn and E. R. Tompkins.	2651

DOCUMENTS REFERENCE LIST

Document	Title, Author	Abstract
ORNL-586	Chromosomal Interchanges Induced in Tradescantia Microspores by Fast Neutrons from Uranium Fission. N. H. Giles, Jr., and A. D. Conger.	2504
ORNL-587	The Isolation and Characterization of Spleen Ribonucleic Acid. E. Volkin and C. E. Carter.	2653
ORNL-590	Fast Neutron Continuous Monitor and Survey Meter. R. J. Farber.	2754
ORNL-600	Review and Outline of Present Laundry Procedure at ORNL. H. J. McAlduff, Jr.	2524
ORNL-602	A Portable Alpha Survey Meter. W. M. Hurst, G. S. Hurst, and W. B. McDonald.	2730
ORNL-610	The Separation of Adenosine Polyphosphates by Ion Exchange and Paper Chromatography. W. E. Cohn and C. E. Carter.	2654
UCRL-421	Radioactive Isotopes of the Rare Earths. III. Terbium Isotopes. G. Wilkinson and H. G. Hicks.	2769
UCRL-453	A Device for Determining the Magnetic Plane of Symmetry in a Time-Varying Electromagnetic Field. R. E. Richardson, W. J. Stephan, R. Younkin, and D. Sewell.	2785
UCRL-454	Procedures in Magnetic Measurements at the University of California Radiation Laboratory. R. E. Richardson.	2786
UCRL-455	Use of the Characteristics of Permalloy in Detecting a Predetermined Value of Magnetic Field or Current in a Time-Varying Electromagnet. R. E. Richardson, R. L. Shuey, R. Younkin, and W. J. Stephan.	2787
UCRL-456	Method of Operation of the Permeameter. R. E. Richardson.	2788
UCRL-575	Summary of the Research Progress Meeting of December 22, 1949. H. P. Kramer.	2797
UCRL-583	The Decomposition of Water by Radiation. W. J. Toulis.	2649
UCRL-591	The Path of Carbon in Photosynthesis. IX. Photosynthesis, Photoreduction, and the Hydrogen-Oxygen Carbon Dioxide Dark Reaction. E. J. Badin and M. Calvin.	2587
UCRL-598	Summary of the Research Progress Meeting of February 2, 1950. H. P. Kramer.	2680
UCRL-601	Summary of the Research Progress Meeting of January 6, 1950. H. P. Kramer.	2681
UCRL-604	Brief Comparative Specifications — Radiation Laboratory Accelerators. M. A. Gunst.	2789
UCRL-609	Summary of the Research Progress Meeting of February 9, 1950. H. P. Kramer.	
UCRL-616	The Half-Life of Po^{208}. D. H. Templeton.	2806
UCRL-618	Summary of the Research Progress Meeting of February 16, 1950. H. P. Kramer.	2683
UR-94	Studies on Factors Effecting the Radiation Syndrome. I. The Effect of Aureomycin and Antibiotics on Whole Body Irradiation. J. W. Howland, F. Furth, L. R. Bennett, M. Coulter and G. M. McDonnel.	2540
Y-546	The Isotopic Analysis of Nitrogen by Means of a Microwave Spectrograph. A. L. Southern, H. W. Morgan, G. W. Keilholtz, and W. V. Smith.	2588
Y-568	Preparation of Sulphur, Selenium, and Tellurium Hexafluorides. H. R. Gwinn.	2641

GENERAL

2501 Atomic Energy Project. D. A. Keys. In National Research Council Review, 53-71. Ottawa, Canada, 1949. (NRC-1997.)

This is an account of installations and equipment at Chalk River and of the projects and studies under way in the various departments.

BIOLOGY AND MEDICINE

2502 Calculation and Statistical Analysis of the Biochemical Oxygen Demand Velocity Constant. Werner N. Grune. NYOO-1501, Nov. 1949. 40p.

The Biochemical Oxygen Demand (B.O.D.) of sewage and organic wastes is very distinctly described by a reaction velocity constant. In this approach the sanitary engineer has applied the chemist's tool of a unimolecular reaction to which the B.O.D. very closely conforms. Several factors that influence the value of this velocity constant have been treated statistically in this progress report in order to gain a better understanding of it for further experimentation and research. The foundation for the evaluation of the effect of radioisotopes on domestic sewage has now been completed, and the addition of isotopes can proceed. 13 references. (auth)

2503 The Negation of Squid Embryo Tropisms by X-radiation. Roberts Rugh. NYOO-1502, Jan. 16, 1950. 18p.

The squid embryo, hatched or unhatched, shows marked positive heliotropism and negative geotropism, and its chromatophores are relatively large and active. When encapsulated (unhatched) embryos are x-irradiated to 25,000 r they are liberated, due to a swelling and rupturing of the jelly capsules. The strong heliotropistic responses are negated in many specimens after exposure to 10,000 r; but 100,000 r completely nullifies this response in all larvae, although they remain motile for days. The geotropistic response is a bit more resistant, but is also nullified by 100,000 r. These reactions are immediate. Growth is stopped by x-radiations to 5,000 r or more so that the relatively large embryonic chromatophores remain as they were at the time of exposure. There are no histological corollaries of these radiation effects for 3 to 4 days after exposure, at which time those exposed to 800 r or more show retinal disorganization and lens involvement. It must be postulated that the retina was functionally damaged some time before there was histological evidence. (auth)

2504 Chromosomal Interchanges Induced in Tradescantia Microspores by Fast Neutrons from Uranium Fission. Norman H. Giles, Jr., and Alan D. Conger. ORNL-586, Feb. 28, 1950. 11p.

Inflorescences of Tradescantia paludosa (Sax, clone No. 5) were exposed to fast neutrons from uranium fission, utilizing a special exposure device in the Oak Ridge pile; and the yield of chromosomal interchanges (dicentrics and centric rings) was determined in microspore nuclei on the fourth and fifth day following irradiation. A linear relationship was found between neutron dose and interchange frequency, confirming previous evidence that fast neutron induced interchanges are one-hit phenomena. Further evidence has been obtained that the interchange yield for a given ionization dose is inversely related to the energy of the fast neutrons utilized. This relationship can be interpreted in terms of differences in ionization distribution within nuclei. The greater efficiency of less energetic fast neutrons is in accord with the view that several ionizations are required to produce a chromosome break in Tradescantia. (auth)

2505 Abstracts of Papers Accepted for Presentation at the Forty-first Annual Meeting of the [American Phytopathological] Society, New York City, New York, December 28 to 30, 1949. Phytopathology 40, 1-33(1950) Jan.

Among the papers presented were the following: Cultural Characters of Uranium-Nitrate-Induced Mutants of Ustilago Zeae, J. M. Daly and S. I. Lu. Effects of Continuous Gamma Radiation on Tomato Plants and Fusarium Wilt. A. E. Dimond. The first of the two papers presents the results of a study of 13 characters of 198 mutants from the monosporidial, unisexual line 17D4 of Ustilago zeae. Plus or minus deviations in color, topography, radial growth, rate of growth, elevation and other characteristics are included. In the second paper, the results of the irradiation of Bonny Best tomatoes and cultures of Fusarium lycopersici from a 20 rhm source of γ radiation (Co^{60}) are presented. Spores of the Fusarium exposed to 32,000 r over a period of 2 months showed a mortality of less than 15%. When the dosage was less than 50,000 r, tomato plants receiving 150 r/hr grew only slightly while exposed, but normally after irradiation ceased; higher total dosages produced severe and permanent irradiation injury. Other irradiation effects are described.

2506 Abstracts of Papers Presented at the 1949 Meetings of the Genetics Society of America. New York City, Dec. 28-30, 1949. Genetics 35, 95-141(1950) Jan.

Among the papers presented were the following: Alteration of the X-ray Sensitivity of Drosophila by Means of Respiratory Inhibitors, William K. Baker and Elizabeth Sgourakis. The Effect of Boron Enrichment on Slow Neutron Irradiated Tissues, Alan D. Conger. Chromosome Breakage by X-rays at Low Temperature and the Radiodecomposition of Water, A. C. Fabergé. A Reconsideration of the dp Locus in Drosophila Melanogaster, Seymour Fogel. The Effects of Supplementary Treatment with Infrared Radiation on X-ray Induced Lethals and Chromosome Aberrations in Females of Drosophila Melanogaster, Bentley Glass. Radiation Effects on Mice as Related to Survival, John W. Gowen. Photorecovery of the Effects of Ultraviolet Radiation on Paramecium Aurelia, R. F. Kimball and Nenita T. Gaither. Genetic Changes Accompanying the Uptake of P^{32} by Drosophila Melanogaster, R. C. King. X-ray Induced Genetic Effects in Germinal and Somatic Tissue of Drosophila Melanogaster, George Lefevre, Jr. The Production of Mutations at Individual Loci in Drosophila by Irradiation of Oocytes and Oogonia, H. J. Muller, R. M. Valencia, and J. I. Valencia. Penicillin Isolated Biochemical Mutations in Salmonella Typhimurium: Their Proportionality to X-ray Dosage, and Their Failure to Show Recombination, H. H. Plough. Effects of High Dosage of X-rays in Paramecium Aurelia, E. L. Powers and Deborah Shefner. The Effect of Oxygen on the Frequency of X-ray Induced Chromosomal Aberrations in Tradescantia Microspores, Herbert Parkes Riley and Norman H. Giles, Jr. The Pattern and Significance of Delayed Phenotypic Expression of Mutations Induced in E. coli by Absorbed P^{32}, B. A. Rubin. Tolerance of Tradescantia to Continuous Exposures to Gamma Radiation from $Cobalt^{60}$,

Arnold H. Sparrow. The Effect of Irradiated Medium, Peroxide, and Cyanide on the Mutation Rate in Neurospora, R. P. Wagner, C. H. Haddox, R. Fuerst, and W. S. Stone. The Noninduction of Mutations by X-rayed Cytoplasm, Anna R. Whiting. Mutant Types in Mormoniella, P. W. Whiting. Some Effects of Gamma Rays upon Recombination Frequencies and on Crossing over in Drosophila Melanogaster, Maurice Whittinghill.

2507 The Action of Radioactive Phosphorus in Drosophila. Johanna Blumel. Science 111, 205-6(1950) Feb. 24.

In the present investigation, radioactive P^{32} was used to study the action of β rays on Drosophila melanogaster and Drosophila virilis. Pairs of mature flies were placed in shell vials containing a culture medium, consisting of a standard Drosophila culture medium and added radioactive H_3PO_4; the original volume (about 300 ml) of medium, with a count of 265,000 cpm/ml, was distributed among 50 vials in 6 ml amounts. Twelve days after exposure, the distribution of radioactivity in the various tissues of the insects was determined; few of the D. virilis generation hatched in the radioactive solution survived, and none of the adults were tested, but in the case of D. melanogaster, the hatch was normal and all present, adults and larvae, were examined. All hatched individuals of D. virilis strain were morphologically abnormal, the abnormalities pertaining mostly to the eyes, legs, abdomen, wings, and genitalia. Other data indicate that radioactive P^{32} not only produces mutations in D. virilis but also chromosomal rearrangements. The tolerance to such irradiation is considered to be high.

2508 Analysis by Radiation of Biological Elementary Structures. Gerhard Schubert. Strahlentherapie 80, 1-16(1949)(in German).

This is a review article, written primarily from the standpoint of the target theory, on the effect of radiation on elementary biological structures such as genes, bacteriophages and viruses. In particular, the number of hits on a target necessary for biological effects, the role of energy migration in the elementary structure, and the possible size of the elementary target regions as deduced from irradiation experiments are discussed in some detail.

2509 Biological Radiation Effects of Fast Electrons on Germinating Barley. W. Dittrich, W. Paul, M. Riedel, and G. Schubert. Strahlentherapie 80, 17-34 (1949)(in German).

After 24 hr of swelling in water, barley kernels were subjected to irradiation by fast electrons of 4 Mev energy. The results were compared with nonirradiated and with x-ray-treated kernels. Measurements were made of the time it took the coleoptile to break through the soil, and the time that passed until the first leaf broke through the coleoptile-sheath, as well as of the length of growth of the leaf. With increased dosages the inhibition of the germinal growth became greater and the percentage of coleoptiles breaking through the soil was smaller; the length of growth of the leaf under the same conditions became more and more retarded. Electrons with different energies (2 to 5 Mev) did not produce any different biological radiation effect if equal dosages were used. Fast electrons were less retarding and less damaging than x-ray unit doses. Theoretical implications of this fact are discussed. Small dosages (1600 r and less) of fast electrons had a growth-stimulating effect. 14 references.

BIOLOGY AND MEDICINE

2510 Chemical Actions of Ionizing Radiations on Aqueous Solutions. Part I. Introductory Remarks and Description of Irradiation Arrangements. F. T. Farmer, Gabriel Stein, and Joseph Weiss. J. Chem. Soc., 3241-5(1949) Dec.

The development of the theory of the action of ionizing radiations on aqueous solutions, leading up to the theory of formation of free radicals (Weiss, Nature 153, 748(1944)), is discussed. Apart from the intrinsic interest in the action of the radiations, these investigations are of interest because they allow the reactions of free radicals to be studied in the absence of interfering reagents and because the products of reaction are somewhat similar to those obtained in biological systems in which the same molecules are involved. Experimental arrangements for irradiations with x-rays (γ rays), neutrons, and α rays, and the radiation dosimetry, are discussed in detail. (auth)

2511 Effect of Large Doses of X-rays on the Distribution of Alkaline Phosphatases in Some Organs of the Mouse. L. Arvy, J. A. Boiffard, and M. Gabe. Compt. rend. soc. biol. 143, 233-4(1949).

Histological changes are described in adult white mice given whole body radiation of 2,000 r. The Gomori technique showed characteristic shifts in alkaline phosphatase in the cells of the spleen, intestine, and kidney.

2512 The Effect of X-radiation on the Metabolic Processes of the Resting Cell. Theodore N. Tahmisian. J. Exptl. Zool. 112, 449-63(1949) Dec.

Studies on the effect of high dosages of x-rays on respiration and the relationship of nuclear degeneration to the anabolic processes of the cell were conducted utilizing grasshopper eggs (Melanoplus differentialis) of known chronological, morphological, and physiological ages. After reaching the age of 40 days, and when in diaphase, the eggs were divided into six groups, five of which were irradiated at 200 kv with no filtration except the petri dish, at a target distance of 2 cm and at the dosage rate of 1563 to 1588 r/min; doses were 25,000 r, 50,000 r, 100,000 r, 150,000 r, and 200,000 r for the different groups. Immediately following the irradiation each group was equally divided and one-half was maintained at 0°C and the other half at 25°C while respiration was measured; physiological, and morphological examinations were carried for a period of 40 days after the irradiation. It was found that dosages of 25,000 to 200,000 r did not completely inhibit respiration. Anabolic enzymes were found to be associated with the nuclear material and were more susceptible to the radiation damage than the catabolic enzymes; in a resting cell a nucleus was found to be necessary for the maintenance of the status quo. Pyknosis of the resting nucleus was found to depend upon the x-ray dosage, the state of metabolism and the time. Repression of irradiation damage to the cell could be obtained by subjecting the cells to submetabolic temperatures.

2513 Effects of X-irradiation on Plasmodium Gallinaceum and Plasmodium Lophurae Infections in Young Chicks.

BIOLOGY AND MEDICINE

B. E. Bennison and G. Robert Coatney. J. Natl. Malaria Soc. 8, 280-9(1949) Dec.

Selected groups of Rhode Island red chicks (Gallus gallus) were infected when 4 to 12 days old with Plasmodium gallinaceum of Plasmodium lophurae and were used as donors when 20 to 50% of the red blood cells contained parasites. Blood was drawn from the heart, heparinized, and diluted with NaCl solution and injected in 0.1 to 0.2 cc amounts into the right jugular vein of similar young birds. Several groups of the inoculated birds were exposed to 400 r of single beam x-irradiation on or about the day of inoculation and while covered with two layers of cheesecloth. The x-ray tube was operated at 200 kv with a 0.25-mm Cu and 1.06-mm Al filtration; the target distance was 40 cm and the intensity of irradiation was 68 r/min measured in air. Some groups of the infected birds were also treated with quinine twice daily for 4, 8 or 11 days, the first dose being administered 5 hr after the inoculation of parasitized blood; the dosage of the drug was 0.2 mg/g body weight. The chicks exposed to the x-rays showed significantly higher parasite counts than the unirradiated controls, while parasite counts of irradiated quinine-treated chicks (inoculated with P. gallinaceum) were slightly higher than those of unirradiated quinine-treated controls. The parasite counts of x-rayed female chicks averaged significantly higher than those of irradiated males, with or without quinine treatment.

2514 Incidental Finding of Megaloblastic-Like Cells in Bone Marrow of One of Two Swine with Macrocytic Anemia and Achlorhydria. F. Douglas Lawrason and E. P. Cronkite. Yale J. Biol. Med. 22, 57-66 (1949) Oct.

Extensive hematological observations were made on two swine (Z) for 17 months after they were exposed to atom bomb ionizing radiation at Bikini. Red blood counts were compared with test swine beyond the range of significant radiation, several surviving heavily irradiated swine, and controls; white blood counts were compared with test swine beyond the range of significant radiation and surviving swine subjected to heavy radiation. The results are discussed in terms of nutrition, radiation, age, and previous history of the animals. The authors found in blood microscopic analyses and marrow smears evidence for true macrocytic anemia in both animals (Z) and a hyperplastic megaloblastic-like bone marrow in one. Achlorhydria was found in both animals (Z). 32 references.

2515 Lethal Injuries of Drosophila Eggs by X-rays and Fast Electrons from a 6-Mev Betatron. H. Fass, G. Höhne, W. Paul, and G. Schubert. Naturwissenschaften 36, 381-2(1949)(Brief note, in German).

Lethal dosage curves are given for drosophila eggs, aged 3 hr, 4 hr, and 7.5 hr, respectively, with x-rays (180 kev, 6 ma, 0.25 mm Cu half value layer, 185 r/min) and with 3-Mev electrons. The relative biological effectiveness of the electrons compared to the x-rays was found to be 1.0, 0.4, and 0.8, respectively, for the three age groups. An attempt is made to interpret the lethal dosage curves on the basis of target theory.

2516 The Nature of Radiation Injury to Amphibian Cell Nuclei. William R. Duryee. J. Natl. Cancer Inst. 10, 735-96(1949) Dec.

BIOLOGY AND MEDICINE

In order to determine the physiological mechanism by which cell nuclei are damaged by ionizing radiations, the ovarian eggs of salamanders and frogs and whole animals were irradiated with various doses of x-rays. Two Coolidge tubes were mounted above each other and operated from the same transformer at 182 to 194 kv; no filters were employed, and the target distance from the center of the irradiated area was 35 cm for whole animals and 9.5 cm and 12.7 cm in the case of eggs and nuclei; the irradiation rate was 6,100 to 7,600 r/min for the isolated cells and 450 to 500 r/min, and 2,800 to 6,100 r/min for the whole animals. The total doses were 300 to 100,000 r with the great majority of the experiments being performed at the 30,000 to 60,000 r level for the eggs and at the 300 r level for the whole animals. The details of the experimental procedure are presented. At 3,000 r, 98% of the small eggs showed intranuclear damage within 10 days. Nuclear components irradiated in situ showed differential susceptibility; exposures to low temperature (5°C) delayed the nuclear injury up to 18 days but were unable to prevent pyknosis upon rewarming of the animals. Nuclear and chromosomal injuries in ovarian eggs were roughly paralleled by those in the theca cell nuclei; typical radiation damage in nonirradiated cells could be produced by microinjections of cytoplasmic material withdrawn from irradiated eggs. The conclusion drawn from these and other results is that cellular radiation damage is a triple phenomenon, consisting of: primary physical or radiochemical changes in the cytoplasm; chemical metabolic processes which allow protoplasmic nuclear toxins to form or accumulate in the cytoplasm; and, transmission of toxic substances into the nucleus in 10 to 30 min at 23°C. (auth)

2517 On the Interpretation of the Dose-Frequency Curve in Radiogenetics. I. Opatowski. Genetics 35, 56-9 (1950) Jan.

It is shown that assumptions opposite to those which are made in the single event theory of induction of mutations by radiation, lead to a relation between radiation dosage and frequency of induced mutation which is practically linear within its experimentally pertinent range. It is concluded from this that the apparent linearity of the experimental data on the dependence of the mutation frequency upon the administered dose cannot be considered as a proof that the mutation is caused by a single primary event. (auth)

2518 Pregnancy Following Pelvic Irradiation. Alan M. Giles. J. Obstet. Gynaecol. Brit. Empire 56, 1041-3 (1949) Dec.

Following the insertion of 50 mg of radium into the uterine cavity of a patient, a dose of 2,400 mg hr was delivered, but after 4 months of amenorrhea pregnancy took place. A similar case in which 1,000 mg hr of radium was delivered to the uterine cavity similarly did not prevent subsequent pregnancy. The author concluded that the induction of menopause in women below 40 years of age by this method should be performed only in exceptional circumstances; the risk of failure in young women is considerable. Patients treated by this method should be followed up for a minimum period of 12 months and in the event of failure to induce the menopause, contraceptive measures should be advised. (auth)

2519 The Problem of Radiotoxins. II. Jan Žáček, Vl. Klimecký, and D. Motáček. Spisy Lékarské Fakulty Masarykovy Univ. 22, 8pp. (1948).

BIOLOGY AND MEDICINE

Rat erythrocytes were irradiated with 6,030 r and then were injected subcutaneously into healthy animals as 5 cc suspensions, in order to determine the severity and nature of radiotoxic effects; the leucopenic effects were checked at 24-hr intervals. It was found that the radiochemical changes could not be traced to any particular chemical constituent of the cells; radiotoxins were formed only in the intact, live erythrocytes, probably by complex chain reactions. Hemolysis of the cells prior to irradiation prevented the formation of toxins, while hemolysis immediately after the irradiation stopped the chain reactions and minimized the concentration of toxic material.

2520 The Proteolytic Cleavage of Irradiated Proteins (a Contribution to the Problem of Quantum Biology and the Amplifier Action of Living Cells). Felix Haurowitz and Adnan Tümer. Enzymologia 13, 229-31 (1949).

Serum pseudoglobin in phosphate buffer was irradiated in a quartz tube for 320 min, after which both the precipitated and other protein were incubated with trypsin, and Kjeldahl analyses run on the protein free precipitate. The irradiation was found to have the same effect as heat on the proteins.

2521 Quantitative Inferences Concerning the Genetic Effects of Radiation on Human Beings. Robley D. Evans. Brit. J. Radiol. 23, 175-83(1950) Mar.

This article appeared in Science 109, 299(1949) and was abstracted in Nuclear Science Abstracts as No. 2-1756.

2522 Suppression of Local Tissues Reactivity (Shwartzman Phenomenon) by Nitrogen Mustard, Benzol, and X-ray Irradiation. Robert Mettler Becker. Proc. Soc. Exptl. Biol. Med. 69, 247-50(1948) Nov.

Male albino rabbits were intradermally injected with 0.3 cc of a solution of avirulent type I meningococcus filtrate or endotoxin in three areas, the epigastrium and the right and left lower quadrants. From 20 to 26 hr later, 2 cc of undiluted meningococcus endotoxin/rabbit or 2 cc of the undiluted meningococcus filtrate/kg body weight was injected intravenously through the ear vein. The effects of various agents were studied to determine their suppressive action on the Shwartzman phenomenon produced by the meningococcus. When 13 rabbits were exposed once to 800 r of total body x-irradiation 3 to 7 days before the meningococcal injection there was almost a complete suppression of the reaction in 7 of the rabbits and complete suppression in the other 6; one animal which received 300 r 3 days before injection showed no suppression and two animals which received 800 r of the total body irradiation immediately before the injection also demonstrated no suppression. Benadryl, urethane, crude penicillin extract, penicillin G, streptomycin, mapharsen, BAL, vitamin C, α tocopherol, thyroidectomy, and partial exsanguination had no suppressing effect, but pretreatment with nitrogen mustard or benzol caused complete suppression of the reaction. It is suggested that this study may serve as a basis for a new therapeutic concept in the treatment of diseases involving tissue and vascular reactivity.

2523 Survivors of Bombing of Hiroshima Three Years Later. Frederick George Novy, Jr. Arch. Dermatol. and Syphilol. 61, 379-83(1950) Mar.

BIOLOGY AND MEDICINE

The results of a survey on the skin condition of survivors of the atomic explosion at Hiroshima three years after exposure are presented. Careful examination was made for any ionizing radiation effect such as telangectasia, atrophy, or hyperpigmentation of the skin, but in none of the patients could any of the burns be interpreted as due to radiation injury. It is concluded that there is a remote possibility that one or two instances of chronic cutaneous radiation injury may have occurred at Hiroshima, but it is not probable.

2524 Review and Outline of Present Laundry Procedure at ORNL. H. J. McAlduff, Jr. ORNL-600, Mar. 1, 1950. 10p.

A decontamination laundry, operated by the Service Department in cooperation with the Health Physics Division, is maintained at ORNL for laundering most of the work uniforms worn on the plant area. Clothing worn by members of the Instrument Shops, the Research Shops, and the Urinalysis Group is laundered elsewhere, primarily to avoid cross contamination, as the acceptable level of contamination passed by the ORNL laundry is such that the operation of these groups might be adversely affected. The acceptable limit of clothing contamination is based on the value of 300 mrep/week being considered the maximum permissible irradiation to any part of the body. Since it is unlikely that clothing contamination would be uniformly distributed throughout a garment precise evaluation of the hazard is difficult. The operation of the ORNL laundry is guided by the practical consideration of a number of factors. The volume of clothing and other articles serviced is large and a workable compromise between efficiency of operation and acceptable decontamination limits, complicated at times by the diversified operations pertinent to ORNL, has been strived for. Some of the methods employed have evolved through trial and error; the amount of research applied to laundry decontamination problems has been far from exhaustive. The formulation of a laundry procedure for any plant would obviously be guided by the operations pertinent or peculiar to that site and the extent to which these operations are carried out. At locations using isotopes the use of a specific decontaminant for the respective isotopes could well be investigated. The use of citric acid as the primary decontaminant in the ORNL procedure has been moderately successful as good complexing is obtained with many of the materials ordinarily handled.

2525 The Clinical Pathologist in an Atomic Age. Shields Warren. Am. J. Clin. Path. 20, 1-2(1950) Jan.

A general discussion is presented on the role of the clinical pathologist in an atomic era. The available methods for the estimation of the degree of radiation injury done to the human body are briefly mentioned, and the need for an accurate, simple, and quick means of estimation is stressed; with threshold-doses of radiation, individual variations in the response to ionizing radiation may be extraordinarily wide and creates decreasing uniform accuracy. From the standpoint of internal radiation, the most satisfactory method of determination of the degree of radiation received is to determine the amount of radioactive material present in the body or its excretions. The author concludes that since atomic energy is increasingly important to present-day life, there is an increasing responsibility on the part of doctors to learn about this new force, to give thought to its use in peaceful channels and to be prepared, in case it should be used against us, to protect and aid the community.

BIOLOGY AND MEDICINE

2526 Complications Due to Radium Treatment of Collum Carcinoma and Their Significance for Successful Treatment. Friedrich Gauwerky. Strahlentherapie 80, 51-70(1949)(in German).

A total of 590 cases of collum carcinoma were analyzed for complications which might have developed as a result of radium treatment. It was found that 378 cases (64%) were free from complications; 87 patients (14.8%) had developed such radiological complications as erosive proctitis, radiological ulcers of the rectum and radiological lesions and fistulae; 125 cases (21.2%) had developed such inflammatory complications as cystitis, pyelitis, parametritis, peritonitis, etc. Many cases from the literature and the author's own series were analyzed, particularly for injuries of the rectum and of the bladder and for formation of fistulae as a result of an overdose of radium. Where inflammatory processes developed, the chances for successful treatment were greatly reduced, even in otherwise mild cases. 62 references.

2527 Concerning Local Injuries through Irradiation as a Consequence of the Treatment of Collum Carcinoma. H. Drescher. Strahlentherapie 80, 99-106(1949)(in German).

Of 1,039 patients with collum carcinoma treated by radiation therapy, 26 (2.5%) developed injuries of the bladder and of the rectum; 3 of these patients showed injuries of both areas; 4 more patients developed radiogenous rectovaginal fistulae of the bladder. No systematic connection between dosage and injury could be established. After the usually tolerated dosage of 7,000 r for the bladder was increased to 8,500 r in order to obtain higher healing effects, neither x-ray ulcers nor carcinoma, nor spontaneous fractures of the femur neck were observed. Radiogenous shrinkages in the parametrium and subsequent stenosis of the urethra are mentioned. 20 references.

2528 Concerning New Radiation Protection Rules for the Construction and Erection of Medical X-ray Apparatus and Equipment. Herbert Graf. Stuttgart, Georg Thieme Verlag, 1949 (in German) 72p.

This small book, of highly technical character and written by an author well-known in the field of radiation protection, presents rules and principles for protection against x-radiations and points out the dangers encountered by patients and operators during the use of x-ray machines. X-ray tubes, lead shields, filters, and other structural details are discussed.

2529 Danger from Radiation and the Blood Picture. Lothar Diethelm and Wolfgang Hilscher. Röntgen Blätter 2, 145-63(1949).

An extensive statistical treatment was given to blood data on average people and on radiologists subject to radiation exposure of up to 10 yr, confirming previous findings. Leucocytes, reticulocytes, ahd hemoglobin were sensitive but eosinophils, monocytes, and erythrocytes were not affected. The normal daily fluctuation of reticulocytes was found to reach a minimum at night and was correlated with the action of sleep.

2530 Delayed Injuries of the Cranium after X-ray Therapy of Intracerebral Tumors. Alfred Vogt. Strahlentherapie 80, 165-74(1949)(in German).

BIOLOGY AND MEDICINE

Two cases are described where injuries of the cranium occurred 5 and 6 years after x-ray treatment. One patient with a tumor of the hypophysis, and the other with acromegaly had been treated with large dosages of deep x-rays (10,500 to 13,200 r), delivered in doses of 300 r, to three fields over a period of 2 months to about 2 years; the radiations were administered by a 185-kv machine, with a filter of 0.5 mm Cu and at a target distance of 40 cm. At three or four places in the cranium, radiogenous fibroses developed. The author warns that fibroses resulting from pressure through growing intra-cranial tumors and other factors have to be carefully distinguished from radiogenous fibrosis in the interest of further treatment of a patient. Since both patients showed relief from their symptoms and could work, the possibility of producing fibrosis should not be a contraindication to radiation therapy of the brain where it is otherwise indicated. 22 references.

2531 Physicians in an Atomic War. Leon O. Jacobson, R. S. Stone, and J. Garrott Allen. J. Am. Med. Assoc. 139, 138-140(1949) Jan. 15.

This is a discussion of medical factors which might come into play in the event of an atomic war and includes references which are applicable to research accidents at present. A survey of facilities and procedure in case of an attack is presented. The similarity of thermal and radiation injuries and the fact that they may occur together make the two inseparable, especially immediately after incidence; both may be treated by means of plasma transfusion, antibiotics, sedation, and administration of antiheparins such as toluidine blue and protamine sulfate. A dose of 50 to 200 r will produce slight leukopenia and thrombopenia, and mild nausea; 200 to 400 r will produce a moderately severe leukopenia and thrombopenia, mild anemia, severe nausea and vomiting, diarrhea and moderate hemorrhagic symptoms; 400 to 600 r will produce all of the previously mentioned symptoms with greater severity and survival with supportive treatment would be only 50% as compared with a few per cent fatality expected in cases of less radiation. Doses greater than 600 r result in almost 100% fatality. Biological research on radiation is discussed with special reference to hematological systems; use of radioisotopes such as P^{32}, Au^{198}, As^{76}, Na^{24}, and I^{131} in research and warfare is mentioned.

2532 The Problem of Excessive Radiation During Routine Investigations of the Heart. T. H. Hills and R. W. Stanford. Brit. Heart J. 12, 45-53(1950) Jan.

An account of the types of measurements made during routine cases of angiocardiography and cardiac catherization is given. Details are provided concerning the possible amounts of excess radiation to which the patient and the technical personnel may be exposed during the routine investigations; suggestions are made as to means whereby the excess exposure to radiations can be avoided or reduced to a safe level. Distance, lead and rubber aprons and gloves, and other protective devices and measures are discussed as close proximity to the patient. Accurate monitoring and calculation of the radiation exposure experienced by the patient are also mentioned as safeguards. (auth)

2533 Radiation Cataracts. Shields Warren. J. Am. Med. Assoc. 141, 407(1949) Oct. 8 (Correspondence).

The development of radiation cataracts is due not to the overestimation of maximum permissible doses but to the

acute exposure of individuals to doses of 20 to 100 r during adjustments of machinery and work inside the protective barriers. Neutron data are not satisfactory as yet to estimate maximum doses but for neutrons as well as for other types of radiation the permissible doses are set up as close to natural background radiation as is compatible with continuation of research. A committee of the National Research Council, supported by AEC, is conducting research and surveys of exposed personnel.

2534 Radiation Hygiene; Hazards to Physicians, Patients, Nurses, and Others from Use of Radioactive Isotopes. W. Edward Chamberlain, R. R. Newell, Lauriston Taylor, and Harold Wyckoff. J. Am. Med. Assoc. 138, 818-19(1948) Nov. 13.

This article appeared in Am. J. Roentgenol. Radium Therapy 61, 726(1949) and was abstracted in Nuclear Science Abstracts as No. 3-540.

2535 Radium, Radon, and Radioactive Isotopes. Brit. Med. J. 4649, 369-71(1950) Feb. 11.

Instructions of the Ministry of Health of Great Britain to hospital boards and committees of hospitals in the National Health Service for obtaining radium, radon, and radioactive isotopes are here abridged.

2536 Recurrences after X-ray Treatment of Benign Hemorrhages. J. Gosch. Zentr. Gynäkol. 70, 684-91 (1948)(in German).

The results of the irradiation of benign hemorrhages with radium are presented. Doses of 2,000 mg hr were usually given, but it was found that even after higher doses, functioning endometrial tissue was still present; there was little effect on the ovary, large follicles and corpora lutea still being demonstrable. It is concluded that recurrences of hemorrhages may be caused by pressure changes in the capillaries of the remaining mucosa, dilated capillaries in atrophic mucosa, endometritis, glandular-hyperplastic endometrium in cases of malignant ovarian tumors, or flaccidity of the uterine walls in cases of submucous myoma.

2537 Sarcoma and Carcinoma Interrelationship in X-ray Treated Lupus Vulgaris. W. Schneider. Strahlentherapie 80, 335-66(1949)(in German).

Nine cases of sarcoma occurring after x-ray therapy of lupus vulgaris are clinically and histologically described in detail. Though in all cases a carcinoma developed first, the co-existence of a sarcoma which had developed after the application of high x-ray dosages was histologically established in six cases. The sarcomas originated from the chronic granulation tissue, not through metaplasia of epithelial cell elements, and were the collision tumor-type, not the carcino-type. The fact that high x-ray dosages were applied and that the sites of the tumors were places of sharply expressed x-ray atrophy leads to the conclusion that these tumors, particularly the sarcoma, originated from severe x-ray injuries. 95 references.

2538 Thrombocytopenic Purpura Complicating Radioactive Phosphorus Treatment in a Patient with Polycythemia Vera. Gould A. Andrews. Am. J. Med. 7, 564-8 (1949) Oct.

After a diagnosis of polycythemia vera had been confirmed on a 67-year-old female patient, phlebotomy was performed

and she later received about 8.4 mc of P^{32} intravenously. About five weeks later she developed severe thrombocytopenic purpura associated with prominent changes in the appearance of megakaryocytes. It is suggested that P^{32} should be used with caution especially in patients who already have thrombocytopenia.

2539 The Acute Radiation Syndrome. L. H. Hempelmann. AECU-379, nd. 6p.

The acute radiation syndrome is the name applied to the group of signs and symptoms which characterizes the injury produced by exposure of the entire body to a large dose of ionizing radiation. It is an acute generalized illness lasting only a matter of weeks and terminating either in death or in complete recovery of the patient. The syndrome differs in this respect from the chronic form of radiation injury caused by repeated or prolonged exposure of the body to radiation. The following unique aspects of this acute type of radiation injury are considered briefly: (1) the third dimensional quality of radiation injury; (2) variation in tissue damage; (3) delayed tissue death. Factors determining the severity of the injury are the dose rate, the type of radiation, and variation in the response of the individual. The clinical response of patients suffering with acute radiation syndrome are discussed in 4 phases occurring in the following chronological order: the initial reaction (prostration, nausea, and vomiting); a period of relative well-being; the gradual development of fever (toxemia) associated with diarrhea, bleeding, infection, and loss of hair; death or prolonged convalescence. Besides the easily discernible bodily reactions there are a number of equally and perhaps more fundamental responses of persons with the acute radiation syndrome which can be detected only by use of laboratory techniques. Changes in the blood cells and in the male reproductive organs can be determined by direct visualization under the microscope of samples of the blood and seminal fluid. Distortion of the normal function of some of the internal organs of the body can often be determined by chemical investigation of the blood and excreta. The results of such laboratory studies on persons (and animals) with the acute radiation syndrome are discussed. The causes of the clinical symptoms, the biochemical and other bodily changes that occur in persons injured by radiation, can often be learned by studying the tissues microscopically. For this reason, great emphasis has been placed on the investigation of the pathological changes observed in the tissues of persons exposed to lethal doses of radiation. These studies in humans have been amplified by similar but more complete investigations in animals. All of this work leads to the conclusion that radiation produces certain kinds of cellular damage that are responsible for tissue injury and for the clinical response of the individual. A great deal of experimental work has been devoted to attempts to develop methods of treatment of generalized radiation injuries. The clinical experience gained from the treatment of injured persons and supplemented by animal experimentation lead to the conclusion that there is no practical way of preventing the death of cells or tissues fatally injured by radiation. However, if the body can be helped to survive the acute state of the illness, even the most radiosensitive tissues, such as the bone marrow, may regenerate to the point where they can carry on their normal functions. There are a great number of ways in which the body can be helped through the acute state of the illness. Thus, blood transfusions to replace temporarily the red and

white blood cells; penicillin to prevent infection, and certain materials (toluidine blue) to diminish the clotting time of the blood are all of therapeutic value. Other forms of treatment such as maintenance of the water and salt content of the body, which are apt to be disturbed in any serious illness, are very helpful.

2540 Studies on Factors Effecting the Radiation Syndrome. I. The Effect of Aureomycin and Antibiotics on Whole Body Irradiation. Joe W. Howland, Frank Furth, L. R. Bennett, Molly Coulter, and G. M. McDonnel. UR-94, Oct. 14, 1949. 35p.

Results are presented in considerable detail on the exposure of more than 600 rats and 8 dogs to lethal doses (LD_{90-100}) of 250 kvp x-radiation. Observations of the treatment of a proven lymphoma (Hodgkin's type) of liver and spleen are also given. Clinical doses of aureomycin given therapeutically to rats in the diet or drinking water can cause almost complete alleviation of the diarrheal state following lethal doses (LD_{90}) of 250 kvp x-radiation. As such it is superior, to date, to other antibiotics tested, including chloromycetin, streptomycin, sulfadiazine, and penicillin. Survival of life is prolonged an additional 5 to 7 days. The animals die of a hemorrhagic death which is not considered to be typical of a radiation death for this species. Animals may regain pre-radiation weights as early as 3 or 4 days following the exposure. Bacteriological studies indicate a suppression of the normally occurring gram negative organisms in the intestinal tract. Possible causes of the sudden mass mortality are discussed. Dogs treated with clinical doses of aureomycin or combined aureomycin-streptomycin have definitely shown no evidence of radiation sickness and have had bleeding tendencies associated only with local trauma. Three of 6 animals treated in this manner have survived cumulative doses of as much as 750 r in the last 14 months, including 450 r at the time of the experiment. Pathological findings in the late deaths resemble somewhat atypically those noted in the hemorrhagic period for the species 14 to 28 days. Bacteriological studies show depression of sensitive organisms. The case history of one patient with proved lymphoma of Hodgkin's type is included. From a careful study of the presented data one can state that a favorable step has been made toward the understanding of the radiation sickness which follows localized abdominal irradiation in the human subject under treatment for malignancy of the abdominal viscera and adjacent areas. Caution is advised in the further treatment of human cases before a better understanding of the nature of the coagulation of abnormality is determined. An analysis of the physiological approach necessary in the study of the biological effects of penetrating ionizing radiation is given. 36 references. (auth)

2541 Abnormal Bleeding. J. Garrott Allen, Burton J. Grossman, Richard M. Elghammer, Peter V. Moulder, Charles L. McKeen, Leon O. Jacobson, Mila Pierce, Taylor R. Smith, and James M. Crosbie. J. Am. Med. Assoc. 139, 1251-4(1949) Apr. 30.

Data on six cases of hemorrhage (one due to irradiation by P^{32}) include reports on clotting time, protamine titration, erythrocyte, leucocyte and thrombocyte counts, prothrombin activity and clot retraction, and fibrinolysin. Protamine sulfate and toluidine blue were given with good results in all cases. When the bleeding was uncomplicated, protamine sulfate (50 mg in 5 cc of water intramuscularly every 4 to 6 hr, and 150 mg in saline slowly intravenously) is preferred to toluidine blue; isotonic saline solutions of 6 to 8 mg/kg body weight are given slowly intravenously once a day for three days and then half of this dose for three following days. The authors conclude that abnormal bleeding may result from the presence of heparinoid substances in the blood accompanied by increased protamine titration, frequently a prolonged clotting time and in some cases severe thrombopenia; the bleeding was controlled by toluidine blue and/or protamine sulfate, either of which is capable of reacting with several endogenous substances both like and unlike heparin; thrombopenia did not respond to either, and in cases where it was accompanied by an increased protamine titration, the response was insufficient to eliminate splenectomy, since the two conditions are probably independent; it is concluded that the random use of the two compounds will lead to random results.

BIOLOGY AND MEDICINE

2542 The Diagnosis of Radiation Injury. Richard T. Street and John B. Street. Dental Students Mag. 28, 14-17, 34(1950) Feb.

A general discussion is presented on the diagnosis of radiation injury in which the blood picture, cell changes, effects of cumulative exposures, superficial lesions, preblood counts, and other topics are briefly covered under separate headings.

2543 Toluidine Blue in Bleeding Associated with Thrombopenia. J. E. Holoubek, J. V. Hendrick, and W. J. Hollis. J. Am. Med. Assoc. 139, 214-16(1949) Jan. 22.

This is a report on three cases of petechial bleeding and oozing, secondary to a thrombopenia, in which toluidine blue was used. There are incomplete data on heparin titrations but the authors conclude that with a proper selection of cases this may be a valuable adjunct to therapy. Mention is made of toluidine blue filtrations done on 30 other cases of purpuric states associated with thrombopenia.

2544 Autoradiograph Technique. I. Doniach and S. R. Pelc. Brit. J. Radiol. 23, 184-92(1950) Mar. (See also NSA 4-1359.)

This is a discussion of the physics of the autoradiographic technique. A formula is developed to calculate the number of developed grains per unit area for the equipment used, and the stripping film technique is described in detail. Some photographs of thyroid autoradiographs are included.

2545 Studies of the Eye with Radioiodine Autographs. Ludwig von Sallmann and Beatrice Dillon. Am. J. Ophthalmology 33, 429-40(1950) Mar.

The distribution of iodine was studied in radiographs of the eyes of young albino rats after local and systemic use of radioactive inorganic iodine (I^{131}). The methods and techniques are presented. The radioactive indicator was accumulated in the cornea and to a lesser degree in the anterior uvea after iontophoretic introduction from the cathode. A relative accumulation of radioiodine in the cornea as compared to other parts of the eye was also observed at various time intervals after systemic use; ocular tissues contained more of the tracer element than the ocular fluids; infiltrated

BIOLOGY AND MEDICINE

areas in the cornea seemed to trap more of the radioactive indicator than the rest of this tissue. In endophthalmitis the aqueous humor and, in a moderate way, the base of the vitreous produced increased darkening in the radiographs. Radiographs of 10-μ sections of eyes were obtained 24 hr after systemic use of I^{131} but were not found useful for more accurate localization of the labeled compound in the tissues. Almost all of the radioiodine in the cornea is extracted in the acid-soluble fraction. A minimal amount of iodine could be determined in the protein-lipid residue 24 hr after injection of the radiotracer. 18 references. (auth)

2546 Cancer of the Larynx; Five-Year End Results in a Series of Patients Treated Between 1930 and 1942. Chevalier L. Jackson, John V. Blady, Charles M. Norris, and Walter H. Maloney. J. Am. Med. Assoc. 138, 1080-3(1948) Dec. 11.

The results of 612 cases of laryngeal cancer treated by laryngofissure, laryngectomy, and irradiation are summarized. A complete statistical breakdown of the cases is given in terms of recurrence, metastases, second treatment, deaths, survivals and type of treatment given. X-rays, radon tissue implants of 5,000 to 10,000 γ and surgical techniques were used singly or in combination, 159 of them receiving some type of initial radiation. The authors conclude that criteria for therapy selection should be evaluated on the basis of end result analyses similar to this.

2547 Carcinoma of the Cervix (Stage I) Treated Intracavitarily with Radium Alone; Five-, Ten-, and Fifteen-Year Results; Recurrences after More than Five Years. Juliette Baud. J. Am. Med. Assoc. 138, 1138-42(1948) Dec. 18.

This is a complete report of 105 cases of cervical carcinoma treated with local radium application or intravaginal irradiation. Endouterine application was accomplished by sounds of 1-5 tubes of Ra filtered through 1 mm Pt, with 6.66 mg - 13.33 mg Ra/tube which were lined with Al leaf and were flexible; intravaginal irradiation was accomplished with the colpostat, containing tubes of 13.33 mg Ra placed in each lateral fornix and independent tubes of 6.66 mg Ra in front of the cervix. The dose delivered was 3,200 to 5,230 mg hr in the uterine cavity and 3,200 to 4,700 mh hr in the vagina. Age and poor condition contraindicated large doses. Septic complications were rare and confined to early work; rectal complications consisting of alternating diarrhea and constipation, tenesmus, and hemorrhoids occurred in a total of 15 patients most of which had had previous rectal histories; one patient developed a necrotic ulcer of the anterior rectum 8 months after treatment, which was attributed to a technical error that could have been avoided. Recurrences and general patient histories are tabulated with the results showing about 75% five-year cures. The author concludes that cure of epithelioma of the cervix uteri in stage I can be obtained by radium treatment alone as well as by radium and roentgen treatment. Further studies are being done (in which recurrence factors are eliminated by a Wertheim operation) concerning the effects of radium therapy and the verification of pelvic gland conditions.

2548 Concerning the Treatment of Adenoidal Subjects without Polypoidal Growths; in Particular Treatment with Radium Therapy. J. M. Le Mee and L. Porte. Acta Oto-Rhino-Larygologica Belgica 3, 378-86(1949) (in French).

The term adenoidal in the title refers to any hypertrophied condition of the rhino-pharyngeal lymphoidal tissue. A total of 347 children with such conditions were treated with radiotherapy. The radium was administered in 50 mg amounts in a Crowe monel metal container; three applications of 3.5 min each at intervals of three weeks followed by three applications of 12 min each at 15-day intervals were given. The patients were selected with great care; most of them had experienced previous types of therapy without success; the presence of infection was a contraindication. Of 62 cases of acute chronic catarrhal otitis, 52% were definitely improved through the radiotherapy, and of 57 cases of Crowe's syndrome, 36% experienced improvement; other similar conditions showed remarkable improvement.

2549 Concerning X-ray Therapy of Bursitis Calcarea and of Periarthritis Humeroscapularis. Klaus Decker. Strahlentherapie 80, 219-24(1949)(in German).

Thirty-six patients suffering from periarthritis humeroscapularis and from bursitis calcarea were x-ray treated. The irradiation was delivered by a 180-kv machine, with a 0.5-mm Cu filter to a field area of 10 × 15 cm, at a focal skin distance of 40 cm. One course consisted of 6 to 8 sittings 2 to 3 times a week and the irradiation was administered from two shoulder fields in single doses of 200 r. Fourteen patients received a second course after six weeks. All but one of the 36 patients improved; 67% were healed and have been free from symptoms from 3 to 7 years.

2550 Concerning X-ray Therapy of Syringomyelia. Klaus Decker. Strahlentherapie 80, 265-70(1949)(in German).

Twenty men and 7 women were treated for syringomyelia with x-rays delivered by a 180-kv machine, with a 0.5-mm Cu filter, to a field area of 10 × 15 cm and at a focal target distance of 40 cm. The single dose was 300 r delivered daily for a total dosage of 6 skin erythema doses, and in some cases 12 to 16 skin erythema doses. Reaction was good in 17 patients (63%), but healing could not be observed. The success did not depend on the length of time between beginning of the illness and beginning of the irradiation, or on the severity of the illness.

2551 Cyclotherapy of Esophageal Cancer. Moulonguet and Mallet. Mém. acad. chir. 74, 688-92(1948) Nov. (in French).

The results of the treatment of 36 cases of esophageal cancer with radiotherapy are presented. Most of the cases were mediastinal with adjacent adenopathies, and a few were cervical-thoracic. The method of application of the radiations consisted of irradiation through rotating field, with the delivery of large doses of penetrating radiations protracted over a period of 6 to 8 weeks, usually for a total dosage of 5,000 to 6,000 r, although some cases required less. The great majority of the cases showed some amelioration of their conditions following the therapy, and some of the patients were able to return to work. Anemia infrequently resulted, although mediastinitis, bronchic irritation, and coughs were frequently seen as sequelae. Survivals of 5, 6, 9, and 11 months were obtained by this method. These results indi-

cate that the method is a suitable and efficient form of therapy, and is equally efficacious for bronchial cancer.

2552 Experiences with Radioactive Gold Au^{198}. T. Howard Clarke and George V. LeRoy. Proc. Inst. Med. Chicago, 18, 64-5(1950) Mar.

Radiogold in colloidal suspension injected into tissues remains fixed at the site of injection. A 50,000 er dose has been found effective without harmful local or systematic reactions. When radiogold is injected into the blood stream approximately 80% is fixed in the liver.

2553 Hematology for Students and Practitioners. Willis M. Fowler. New York, Paul B. Hoeber, Inc., 1949 (sec. ed.). 535p.

The second edition of this text includes revised and additional data on the use of radiation in hematological disorder, especially on the use of radioisotopes such as P^{32}.

2554 Hyperthyroidism: Treatment with Radioactive Iodine. Sergei Feitelberg, Paul S. Kaunitz, Solomon Silver, Norman Simon, Louis R. Wasserman, and Stephen Bennett Yohalem. Arch. Internal Med. 85, 471-8 (1950) Mar.

The results of the treatment of 184 patients with hyperthyroidism by I^{131} are presented. The average quantity of the isotope administered was 8.2 mc, with a maximum initial dose of 11 mc and a minimum effective dose of 1.7 mc; an average of about 80 μc was taken up per gram of thyroid tissue. One hundred and thirty-two of the patients were cured with a single dose of I^{131}, 43 required a second treatment, and 9 had 3 treatments; 2 patients in the last category required the third treatment 5 and 11 months, respectively, after an apparent remission. Radiation sickness was not observed in any of the cases, nor was there any effect on the peripheral blood; in only 4 patients was there tenderness or swelling of the thyroid gland after therapy. In 13 of the patients hypothyroidism developed after treatment, but was readily controlled by desiccated thyroid. Two of 3 patients with progressive exophthalmos before the therapy continued to demonstrate this condition after therapy. The authors consider that the very large cure rate (182 patients) indicates that the internal radiation of I^{131} is the treatment of choice for patients with diffuse toxic goiter.

2555 Indirect X-ray Irradiation and the State of Reaction of the Skin. Margret Zingsheim. Strahlentherapie 80, 115-20(1949)(in German).

In order to determine the therapeutic effect of indirect (secondary) irradiation on skin diseases, 100 patients with eczema of the skin were treated with x-rays from a 185-kv machine, at a focal-skin-distance of 30 cm, delivered to a field area of 10 × 15 cm on the back. Thirty patients received 100 r each, 30 received 200 r each, and a third group of 30 received 300 r each; in addition 10 persons without skin diseases were given 100 r, and 10 more received 200 r. Before the irradiation began, exact skin tests were made with dinitrochlorobenzol in concentrations of 0.25, 0.35, and 0.5%. The results showed that patients with eczema had stronger reactions than healthy persons. At 200 r, 90% of the cases who were test-positive before radiation became negative; at 100 r, 25% did not react; a weakening of the reaction was

observed in 25% and a strengthening in 50%. At 300 r the influence became unequal and less favorable. It is concluded that indirect irradiation of 200 r lowers the skin sensitivity, a fact which may prove useful in the treatment of those dermatoses which are difficult to influence. 21 references.

2556 Irradiation of the Pituitary Gland in Hypertensive Vascular Disease. Maurice M. Best, Walter S. Coe, John Walker Moore, Edsel S. Reed, and Herbert L. Clay. Am. J. Med. Sci. 219, 276-80(1950) Mar.

A group of 25 patients, followed for a period of 6 weeks to 3 years, with essential hypertension, was treated with 2000 r from a 200-kv machine at a target distance of 50 cm and with a filtration of 2 mm Cu; doses of 200 r were given, as previously recommended, without significant lowering of blood pressure when considered statistically as a group. Seventeen patients (68%) had symptomatic improvement; three patients (12%) showed a fall in blood pressure of 30 mm Hg systolic or 20 mm Hg diastolic, but no other objective evidence of improvement was noted. The 18 control patients were managed in an identical manner with the treated group with the exception that roentgen therapy was not actually given. Of the 18 patients, 14 (77.7%) were improved symptomatically. Three of these patients (16.6%) showed a fall in blood pressure of at least 30 mm Hg systolic or 20 mm Hg diastolic. (auth)

2557 A New Method of Radium Treatment of Cerebroglioma Intra Operationem. F. W. Kroll. Strahlentherapie 80, 209-12(1949)(in German).

After the operation of a cerebroglioma, either two radium applicators with 45 mg hr radium each or one radium applicator with 90 mg hr radium are introduced into the tumor cavity and are left there for 9 to 10 hr after the operation. A thread is fixed to the radium applicators by which they are pulled out of the cavity through a small opening left in the dura mater; after the removal of the radium applicators, only the galea and the skin are completely closed. The effective dosage is at least 500 to 1,000 mg hr of radium irradiation given within 6 to 10 hr.

2558 Peritendinitis Calcarea of the Shoulder (A Clinical and Radiographic Analysis of 354 Cases). A. C. Galluccio and H. Herscher. Mississippi Valley Med. J. 71, 222-4(1949) Nov.

A total of 354 cases of peritendinitis calcarea of the shoulder were treated by x-ray therapy consisting of the administration of doses of 300 r (in air) at 160 to 200 kv through a filtration of 1 mm Al and 0.25 to 0.5 mm Cu at a target distance of 50 cm; total dosages were 900 to 1,600 r, with most of cases receiving the latter dose. Of the 219 acute cases, more than 85% showed complete relief, and of the remaining more than 50% showed some improvement. In the subacute group more than 70% showed a gratifying degree of relief. It is concluded that the almost universally favorable response of this condition to x-ray treatment has proved most gratifying to all concerned.

2559 Present Position of Radiotherapy in Medical Practice. B. W. Windeyer. J. Am. Med. Assoc. 140, 665-9(1949) June 25.

The history of radiation use in English medical centers and suggestions for future equipment are discussed. The

BIOLOGY AND MEDICINE

use of teleradiation, radium applications and radioisotopes has become a standard practice as indicated in a survey of therapy of 4,387 patients in nine general hospitals, 67% of which were treated in some way with radiation.

2560 Primary Uterine Malignancy. J. Edward Hall, John Pepe, and John Tortora. Am. J. Obstet. Gynecol. 59, 634-41(1950) Mar.

An analysis covering 189 cases of primary malignancy of the uterus is presented, 98 of the cases involving the cervix and 91 the corpus; 69 patients with cancer of the cervix and 62 with cancer of the endometrium were used to determine the survival rates. Cancer of the cervix was usually treated by a full course of deep external x-ray therapy to the pelvis, and in many cases contact x-ray therapy to the cervix. The x-ray therapy was delivered at 200 kv at a 50 cm target distance through a filtration of 2 mm Cu and 2 mm Al, 200 to 300 r being delivered daily to each of two ports (of a total of 4 portals) until 2,400 to 3,600 r was given to each of the portals; a Phillips contact ray tube operating at 45 kv with no filtration and delivering 4,000 r directly to the cervix comprised the contact therapy technique. Many methods were also employed for the delivery of effective doses of radium to the cervical lesions. Cancer of the endometrium received intrauterine radium therapy as the primary method of treatment; two 50 mg capsules in tandem formation were applied, followed in 6 weeks by a complete abdominal hysterectomy and bilateral salpingo-oophorectomy; about 3,600 mg hr of radium were given. In the cervical cancer cases, x-ray therapy alone yielded no five-year survivals, radium alone showed 25%, radium and x-ray 53.5%, and hysterectomy and x-ray 50%; the five-year survival of carcinoma of the corpus cases was, radium only 37.5%, radium and hysterectomy 94.1%, x-ray and hysterectomy 66.6%, and x-ray and radium 0%. 16 references.

2561 Propyl and Methyl Thiouracil and Radioactive Iodine in the Treatment of Hyperthyroidism. E. Perry McCullagh. Ohio State Med. J. 46, 127-9(1950) Feb.

The advantages and indications for the use of surgery, methyl, and propyl thiouracil and I^{131} for hyperthyroidism are discussed briefly. It is stated that I^{131} is peculiarly adapted for the treatment of hyperthyroidism. (1) Because of the avidity of hyperactive thyroid epithelium for the isotope, I^{131} can be concentrated in the thyroid about 10,000 times more than elsewhere in the body. (2) Because of its short half-life (8 days), a highly effective dose of irradiation can be applied within the gland. (3) Because the β irradiation emitted by I^{131} penetrates only 1 to 2 mm, no damage to surrounding tissue is sustained. It is claimed that in the hundreds of patients now treated by this agent, no damage to the blood, kidneys, bladder, bone marrow, reproductive organs, or the tissue surrounding the thyroid has been demonstrated. The methods of estimation of the required therapeutic dose of the isotope are outlined. Of 105 patients treated by the author, 28 were followed long enough to draw conclusions from the results; of 19 patients with Graves's disease, all were cured with total doses of 3 to 15 mc, and of 9 patients with nodular goiter, all were relieved of the hyperthyroidism and the goiters made smaller with total doses of 12 to 58 mc. Other advantages of this type of therapy are pointed out, such as little or no medical supervision, no hospitalization and absence of untoward side effects; some disadvantages are also reviewed.

BIOLOGY AND MEDICINE

2562 Radiological Management of Carcinoma of the Tongue. W. F. Robinson. Clin. Osteop. 46, 147-52 (1950) Mar.

Various radiological procedures used in the management of carcinoma of the tongue are discussed. The x-ray therapeutic technique consisted of administering radiations from a 200 to 250-kv source with an added filter equivalent of 2.0 mm Cu and at a target distance of 50 cm; three external ports are used, a midmandibular and two lateral, and daily treatments were administered at the rate of 250 r/day for a total dosage of 2,500 r in air/port; radon seed therapy is also outlined. Of a total of 32 patients treated by the methods described, successful results have been obtained with 15.

2563 Radiotherapy for the Prevention and Obliteration of Corneal Vascularization. Maurice Lenz. Am. J. Ophthalmology 33, 46-52(1950) Mar., Part II.

The results of the treatment of 127 patients for corneal vascularization by radiotherapy are presented; daily doses of 250 r of x-rays were given to the corneal area by a 45 to 100 kv source until a total dose of about 1,500 r was reached. The results of β radiation, usually from a 10 mg radium-D applicator at a daily rate of 1,000 r equivalents and a total dose of 1,200 to 6,000 r equivalents have also been presented. The three factors influencing the outcome of the radiation therapy were the condition of the cornea when treated, the age of the capillaries and the technique of treatment. In 44% of the 84 cases treated with 600 r or more of x-rays, corneal vascularization was prevented or obliterated; 20% of the 44 cases treated with less than 600 r responded adequately. Beta-ray therapy of around 6,000 r equivalents produced the most satisfactory results. 13 references.

2564 Radium Therapy of Plastic Induration of the Penis. Paul Hess. Strahlentherapie 80, 231-8(1949)(in German).

Of 40 cases of plastic induration of the penis which were treated with radium moulages, 10 were healed and 12 improved; 9 patients could not be traced. The optimal dosage was 2,000 to 3,000 r, administered in 2 to 3 series; higher dosages did not bring better results. Injuries to the reproductive cells are concluded to be an important argument against radium therapy in these cases. Eight patients were x-ray treated, but no definite results have as yet been obtained. X-ray therapy may be preferred to radium therapy in order to eliminate the complication described.

2565 Recent Advances in Treatment of Hematologic Disorders. Cyrus C. Sturgis. J. Am. Med. Assoc. 141, 969-73(1949) Dec. 3.

Treatment of macrocytic anemia with folic acid, liver extract, and vitamin B_{12}, and therapy of leukemia by urethane, folic acid antagonists and nitrogen mustard are discussed and described. Roentgen-ray therapy of acute leukemias is considered harmful; total body spray irradiation of 15 - 20 r/day every other day is satisfactory for prolonged life in chronic myelogenous leukemia except in cases of gross splenomegaly when local irradiation of 50 to 100 r/day every other day is used; the same local irradiation dose is used in chronic lymphatic cases. Intravenous injection of sodium phosphate (P^{32}) in doses of 5 to 7 mc giving a total body irradiation of about 50 r is taken up selectively by very active cells and is used therapeutically in chronic myelogenous leukemia and polycythema vera. This dose may be repeated

in 6 to 8 weeks for leukemia, and in 4 to 6 weeks for polycythema vera resulting in a wide tissue dispersion of mild but prolonged effect, no radiation sickness, and, as in the case of roentgen-ray therapy, a partial or total remission of the symptoms for periods up to three years.

2566 Recent Results Concerning the Pathogenesis, Clinical Manifestations, and Therapy of Lupus Carcinoma. W. Hornberger. Strahlentherapie 80, 367-88(1949) (in German).

An increase of lupus carcinoma after the war was observed in Germany (at a clinic in Tübingen), and a special malignity and tendency to form metastases were noted. Lupus carcinoma of the nose, lip, ear, neck, and cheek showed a particularly malignant character, developing during the course of treatment an increasing resistance to irradiation. The radiation therapy of lupus carcinoma is discussed; a certain superiority of radium and the short-distance, small-area type of x-ray therapy was found over deep x-ray therapy, since the tissues of patients with lupus vulgaris could not tolerate any high radiation dosage. The cancerogenous effect of x-ray therapy in these cases was stressed and a combination of other cancerogenous factors which favor the formation of lupus carcinoma was suggested. 49 references.

2567 Remote-Controlled Radium Emanation Plant and Automatic Measuring Apparatus for Gold Implants. John E. Rose and Robert W. Swain. J. Natl. Cancer Inst. 10, 605-24(1949) Dec.

A radium emanation plant equipped for semi-automatic operation is described and is claimed to be unique in that remote control of the stopcocks has been incorporated into the installation. The electrical control apparatus for the semi-automatic operation and the remote controls for the operation of the stopcocks are located in a control room separated from the emanation plant by 2 ft of concrete; a lead glass window and a low-power telescope are mounted in the wall for the observation of the operation of the plant. Since the apparatus consists of glassware and metal which must be replaced occasionally, two complete systems have been built and mounted on each side of a V-shaped frame; either side may be immediately used without delay. A full description is presented of the construction and operation of this device.

2568 A Report on the Use of the Radium-D Applicator. Robert W. Harger and A. D. Ruedemann. Mississippi Valley Med. J. 72, 50-53(1950) Mar. (Selected article).

A more extensive version of this article appeared in Kresge Eye Inst. Bull. 1, 19(1949). It appeared in Nuclear Science Abstracts as No. 4-1030.

2569 Results of Roentgentherapy of Skeletal Metastases of Cancer of the Breast. Francesco Santagati. Radiologia Clin. 19, 51-7(1950) Jan. (in French).

This is a review of 76 cases of bone metastases occurring after the treatment of breast carcinoma with x-rays (in most cases at a focal distance of 30 to 40 cm, with a 160 to 170 kv machine, using a filter of 0.5 mm Cu and 1 mm Al). The treatments consisted of 900 to 2,000 r per field given in series. A total of 34% of the patients did not enjoy any amelioration of their symptoms following the therapy. Of the remaining cases, 15 survived 2 years, 4 for a period of 4 years, 1 for 5 years, 1 for 8 years, and 1 for 12 years. These results are analyzed and correlated with bone changes, tumor histology, metastizing time, and age of the patient.

2570 Results of Treatment of Uterine Cervical Cancer at the First Gynaecological Clinic, Prague, During 1934-1943. J. Venta. Csl. Gynaek. 14, 344-59(1949) (in Czech).

Of 1,548 patients with uterine cervical carcinoma, 370 were operated upon (Wertheim type of operation) and subsequently received irradiation, and 1,187 received irradiation only. The irradiation consisted of γ rays followed by deep x-rays. Radium was applied as follows: 30 mg was filtered with 1 mm platinum and applied by means of a uterine sound intracervically, and another 30 mg, filtered with platinum and cork, was placed in the vaginal fornices or in the crater of the tumor itself. The total dose was, up to 1939, 38 to 44 mcd intracervically and 40 to 46 mcd in the vagina; after 1939, the dose was reduced by 5 to 8 mcd at both sites in order to reduce neighborhood reactions and because of the introduction of contact x-ray therapy. The total dose of x-rays was 9,000 to 14,000 r. For the first period (1934-1938) the 5-year survival rate (without recurrences) was 29.7%; for the second period (1938-1943) (with contact x-ray therapy) it was 31%.

2571 Roentgen and Radium Physics for the Physician. Richard Glocker. Stuttgart, Georg Thieme Verlag, 1949 (in German).

The first chapter of this book which fully discusses the subject of ionizing radiations deals with modern conceptions of the relationship of matter to radiation; it is followed by sections on natural radioactivity, artificial radioactivity, the generation and application of x-rays, the measurement of ionizing radiations, the protection of personnel and problems of diagnosis and treatment with x-rays. Explanations are given of the nature of radioisotopes, nuclear reactions and particle accelerators, and accurate tabular information is provided. A bibliography and an index also appear.

2572 Roentgen Therapy Alone in the Treatment of Advanced Cervico-Uterine Cancer, Including Extensive Post-Operative Recurrences. F. Baclesse. Am. J. Roentgenol. Radium Therapy 63, 252-4(1950) Feb.

Of a total of 78 cases of advanced cervico-uterine cancer treated by x-rays, 14 are alive after five or more years; 72 of the patients received 200-kv therapy, and 6 received 500 kv (none of whom are alive). The five-year survivals were obtained with irradiation from a 200-kv source, through 1 mm Cu filtration, at a target distance of 60 to 70 cm and at the rate of 20 r/min; the later cases received irradiation through decreased fields (120 to 150 sq cm) and more fractionated doses over a longer period of time (8-10 weeks). The tumor dose for the cured cases has been 4,300 to 7,100 r with a total skin dose of 20,000 to 25,000 r delivered through several ports. Since 1943-45 the Curie Foundation has found that it may be possible to deliver an adequate sterilizing dosage (5,000 r) to the parametria in radiosensitive cases through a direct intravaginal field.

2573 Selection of Therapy for Individual Patients with Thyrotoxicosis. Robert H. Williams. J. Am. Med. Assoc. 139, 1064-7(1949) Apr. 16.

BIOLOGY AND MEDICINE

Therapy of thyrotoxicosis is discussed in terms of subtotal thyroidectomy, prolonged thiouracil administration and the application of radioiodine. I^{131} was used in 97 cases and I^{130} was used in three; those treated with I^{130} have had remission of more than 2 years; 5 treated with I^{131} still have thyrotoxicity, 92 have remissions of more than 1 month, and 80 of more than 4 months; myxedema developed in 3 cases and transient hypothyroidism in 13. As many as 5 doses were given to secure remission in intervals of 2 months with total remission dosage varying from 2 to 36 mc. Isotope counts of the gland, urine, blood, and palpation of the gland with reference to size and nodularity failed to establish correlations which would enable a more accurate estimation of dosage. The results are considered good with radioiodine but, it is advised, should be restricted due to inaccurate estimations of the dosage, possible carcinogenic effects and unavailability; it is especially useful in cases which have failed to respond to thiouracils, have toxic reactions to thiouracils, or are bad surgical risks.

2574 Therapeutic Results in Uterine Carcinoma from January 1, 1939, to December 31, 1942. Hans Reichenmiller and Heinz Drescher. Strahlentherapie 80, 175-88(1949)(in German).

Five-hundred and forty cases of uterine carcinoma were treated with radium or x-rays, or were first operated on and then treated with x-rays. Radium-filled applicators were introduced into the uterus for a total dosage of 3,000 to 6,000 mg hr in three sittings over a 21-day period; the total vaginal dosage was 3,960 mg hr. During the radium rest intervals, x-irradiations were administered by a 220-kv machine, with a 0.5-mm Cu filter at a focal target distance of 40 cm, the radiated front and back fields receiving 1× 330 r, 2× 275 r and 3 × 220 r; the series was given on 12 consecutive days. Fifty-two of the patients with a wide vagina were treated in addition to radium and x-irradiation with intravaginal near-radiation of 2 × 400 r/field after an interval of two weeks. Absolute cures were achieved in 38.6% of the cases and relative cures over 5 years in 31.1%, an increase over earlier reports; of the group of 52 women, 23 could be relatively cured over 5 years. Several tables demonstrate the radiation results in the different groups of patients. 15 references.

2575 Third Congress of the Austrian X-ray Society in Vienna, Held on Oct. 28-30, 1948. Strahlentherapie 80, 159-64(1949)(in German).

Among the papers presented were the following: Clinical and Experimental Studies on the Effect of Small X-ray Dosages, R. Pape. X-ray Treatment of Stenocardia, P. Grueneis. Radiation Treatment of Hemangioma, G. Feurstein. Pape treated 400 cases of sinusitis, furuncles, granuloma of the teeth, panaritium and hydrosadenitis with small dosages of 3 to 30 r with good results. In experiments with rat spleen he and Jellinek were able to show that even small dosages of x-rays caused histological changes in the spleen. Through the application of 150 to 200 r/field to the suprarenal gland, Grueneis achieved freedom from symptoms in 200 cases of angina pectoris over periods of months and years when the total dosage was 600 to 1,000 r; the electrocardiogram usually did not show any changes after radiation. Feurstein used a combined treatment of radium and x-ray irradiation in 777 cases of hemangioma in children. In treating infants from 4 weeks of age to one year he achieved 100% healing

BIOLOGY AND MEDICINE

results; at a later age, or in cases of recidivation, 81% of the cases achieved excellent results, 16% good results, while in 3% there was failure.

2576 Treatment of Blood Dyscrasias with Radiophosphorus. George V. LeRoy. Proc. Inst. Med. Chicago, 18, 63-4(1950) Mar.

Effective radiation therapy of certain blood dyscrasias is possible using P^{32} intravenously. With accurately estimated doses it should be possible ultimately to determine the relative effectiveness of internal and external roentgen radiation therapy. This is not possible at the present time because of the small number of cases. (auth)

2577 Treatment of Bursitis of Shoulder. J. S. Rubin. Mississippi Valley Med. J. 71, 225(1949) Nov.

Of 77 questionnaires sent out to patients treated for bursitis of the shoulder by x-ray therapy, 33 replies were obtained, and it was found that 26 of the patients had experienced complete relief over a period of 3 to 51 months after the treatment; in a few cases, the calcium deposits were almost completely absorbed. The treatment consisted of delivering ¼ of a skin erythema dose in air three times a week for two weeks; the machine functioned at 140 kv, at a 50 cm target distance, and with a filtration of 0.25 mm Cu and 1 mm Al. Seven of the 77 cases had demonstrated no improvement in their condition at the end of the treatment. It is concluded that the x-ray therapy is the most effective treatment of shoulder bursitis.

2578 X-Irradiation of Lymphogranulomatosis. Horst Müller. Strahlentherapie 80, 225-30(1949)(in German).

During the last 10 years, 31 men and 26 women were x-ray treated for lymphogranulomatosis. The cases were divided into several categories according to severity of the course of the illness and the grade of generalization. Four cases comprising stage I (only one swollen gland), and 28 cases comprising stage II (with several swollen glands) were treated by deep x-ray therapy. The irradiation was delivered by a 175-kv machine at a target distance of 40 cm, with a half-layer filtration of 0.1 mm Cu; every three days single doses of 200 r were administered from 2 to 4 fields, until the total dosage was 1,500 r. In a third and fourth series the single dose had to be increased to 300 r; total body irradiation was administered with a small dose of 25 r, until a total dosage of 250 r was delivered. The expectation of life was 33.7 months in the irradiated cases. A difference in reaction to the irradiation in the several groups could not be established. 23 references.

2579 X-ray Therapy of Hidradenitis of the Axillae. P. Hess. Strahlentherapie 80, 239-46(1949)(in German).

A total of 660 patients suffering from hidradenitis of the axillae were treated by x-rays, given at a 30 cm distance to a field area of 8 × 10 cm in doses of 100 r; the doses were administered every 3 to 4 days, until healing was achieved; 400 to 1,600 r was delivered. The average dosage was 850 r administered in 25 days. Recidivations did not occur. The author concludes that the short treatment period speaks in favor of the x-ray treatment method.

2580 X-ray Treatment of Diphtheria Carriers. Wolf S. Reichel. Strahlentherapie 80, 247-60(1949)(in German).

One hundred patients, 15 to 72 years old, who were diphtheria carriers were x-ray treated by a 180-kv machine with a filtration of 0.3 mm Cu, at a focal-skin-distance of 30 cm, delivering doses of 150 r to field areas of 6 × 6 cm. Both sides of the neck under the mandibular angle were treated, and in cases where the nose was diphtheria positive, a frontal nose field was also irradiated. The first smear was made after 5 days, and this was continued several times; only if the fourth smear was positive, a second, and if necessary third, irradiation was administered. Twenty-seven cases could not be evaluated; 28 of the remaining 73 patients became bacteria free after the first radiation, 26 after the second, 7 after the third, and one after the fourth radiation, while 11 cases remained positive. Success was therefore obtained in 85% of the cases. This simple method is recommended as an effective measure against diphtheria, particularly during epidemics.

2581 Determination of Uranium in Air Dust Samples by Alpha Counting Methods. John H. Harley and Evelyn Jetter. NYOO-94, Dec. 7, 1949. 8p.

This report describes the handling of air dist samples counted in the Analytical Laboratory, Health and Safety Division of the New York Operations Office. An outline is given of the counting procedure and calculations involved in obtaining results of the desired accuracy. The present established tolerance for uranium in air has been set at 70 disintegrations/min/m^3. This corresponds to approximately 50 $\mu g/m^3$ for U^{238} or natural uranium only. Uranium dust samples are generally taken on the 1⅛ in. Whatman No. 41 papers. Either parallel plate or scintillation counters are used for counting the samples.

2582 Control of Atmospheric Beryllium. Norman P. Pinto. Metal Progress 57, 345-7+(1950) Mar.

The necessary precautions taken by the Sylvania metallurgical laboratory in the processing of beryllium are completely described. This includes a discussion of the ventilation system, the hoods used in the various operations, dust and fume respirators, fresh work clothing provided daily by the company, and medical control.

2583 Dentistry and the Atomic Energy Program. Wm. Ward Wainwright. N. Y. J. Dentistry 19, 325-32 (1949).

U^{233}, Pu^{239} and Am^{241} were shown by radioautographs to localize in dental tissues.

2584 Diagnosis and Treatment of Occupational Metal Poisoning. Leonard Greenburg. J. Am. Med. Assoc. 139, 815-18(1949) Mar. 26.

Some considerations of diagnostic methods for occupational metallic exposures are given with special recognition of the fact that often the presence of the metal is not suspected, yet small amounts may be found in some of the working materials. A discussion of the symptomology of the conditions of poisoning is given with special reference to arsenic, cadmium, mercury, and manganese. Beryllium causes local urticaria followed by papular and vesicular dermatitis and generally causes respiratory disorders ranging from mild pharyngitis to severe bronchitis and pneumonitis with edema; selenium may cause pulmonary and gastrointestinal symptoms, some central nervous system disturbances such as convulsions and loss of reflexes and metal fume fever; tellurium, thallium, and vanadium have similar effects to selenium, with an additional depilatory effect noted for thallium; too few cases are reported as yet to make an evaluation of toxicity of the four. Removal from exposure, local palliatives, oxygen and calcium administration are the most frequently used general treatments depending on the symptomology; BAL is suggested as effective in combining with the sulfhydril radicals in arsenic and acute mercury poisoning, both for skin and eye reactions and systemic reactions when given intramuscularly.

BIOLOGY AND MEDICINE

2585 Investigations on the Problem of Radium Poisoning. V. Results of Physical Measurements in a Case of Professional Radium Poisoning with a Fatal End. Hermann Muth and Hans-Helmut Roth. Strahlentherapie 80, 271-80(1949)(in German).

A chemist working in the radium industry died from continuous exposure to strong γ radiation over a period of 10 yr; he had handled approximately 15,150 mg of radium (as radium salts) and about 7,200 mg of mesothorium (γ equivalent of radium). Physical measurements of 6 different parts of his body during his life time disclosed a deposit of 3 to 4 mg of radium; measurements taken from his suits and laundry revealed strong radiation. Measurements carried out post mortem determined the radioactive deposits present in 1 g of tissue from the lungs, liver, spleen, kidney, brain, skin, skeletal muscle, and heart muscle, and the total activity for the different organs was established; the calculated values are shown in two tables. A special pathological difference found in this case as compared with others was the combined existence of aplastic anemia and fibrosis of the lungs.

2586 Radioactive Rays from Thorotrast Deposits in Living Tissue. H. Maier-Leibnitz, K. Schmeiser, and M. Schwaiger. Z. Naturforsch. 4a, 153-4(1949)(in German).

Thorotrast containing 0.25 g ThO_2/cc was found to be stored in the liver and spleen. The Th content of 1/40 to ½ g tissue was measured by soft γ-ray (47 e.kv) absorption from RaD. Examination of freshly killed tissue showed that the products of Th disintegration are thrown off by the body and contribute a negligible amount to the harmful effects of the deposit.

2587 The Path of Carbon in Photosynthesis. IX. Photosynthesis, Photoreduction, and the Hydrogen-Oxygen-Carbon Dioxide Dark Reaction. Elmer J. Badin and Melvin Calvin. UCRL-591, Feb. 1, 1950. 20p.

A comparison of the rates of fixation of $C^{14}O_2$ in algae for the processes of photosynthesis, photoreduction, and the hydrogen-oxygen-carbon dioxide dark reaction has been made. For the same series of experiments, rates of incorporation of tracer carbon into the separate soluble components using the radiogram method have been determined. The mechanism of CO_2 uptake has been shown to occur via two distinct paths. In all cases studied, essentially the same compounds appear radioactive. The distribution with time, however, differs markedly. (auth)

2588 The Isotopic Analysis of Nitrogen by Means of a Microwave Spectrograph. A. L. Southern, H. W. Morgan, G. W. Keilholtz, and W. V. Smith. Y-546, Jan. 10, 1950. 17p.

BIOLOGY AND MEDICINE

Microwave techniques have been applied to the isotopic analysis of N^{14} and N^{15} in ammonia. The calibrations required and precision obtained are described for the range 0.38 to 4.3% N^{15}. The microwave spectrograph is discussed in relation to the use of stable isotopes as tracer materials. The application of the microwave spectrograph to tracer work with stable isotopes has the advantage of using long life isotopes without radioactive hazard problems. Thus tracer techniques could be used by students in universities where general use of a high level radiation laboratory would not be desirable. Metabolism tracer studies with stable isotopes can be made in the human body. In studying reaction mechanisms advantage may be taken of double or even triple isotope-labeled compounds when mass assay methods are available. The use of double-labeled compounds in biological experiments insures identical conditions for the overall chemical reactions of the groups under study. 13 references.

2589 Accumulation of Radioactive Cobalt by Dividing Yeast Cells. Walter J. Nickerson and Karl Zerahn. Biochim. et Biophys. Acta 3, 476-83(1949).

Experiments are reported showing the relationship between Co^{++} concentration of M/1,000-M/64,000 and growth of the yeast Saccharomyces cerevisiae and Candida albicans in a liquid medium of glucose, glycine, and yeast extract, with continuous incubation for 24 hr, with and without agitation. The techniques of measurement are described; results are given and discussed. The authors conclude that ion suppressing, complex forming substances such as metaphosphate are at the cell surface; the possible mechanism of concentration of cobalt by yeast is discussed.

2590 Appearance of Protein Tagged with Radioactive Iodine in Thoracic Duct Lymph. Harvey Krieger, William D. Holden, Charles A. Hubay, Murray W. Scott, John P. Storaasli, and Hymer L. Friedell. Proc. Soc. Exptl. Biol. Med. 73, 124-6(1950) Jan.

The purpose of the experiments described was to determine the rapidity with which intravenously injected, radioactive protein appears in the thoracic duct lymph. Each of eleven healthy adult fasting dogs was anesthetized and operated upon so as to expose the thoracic duct and a femoral vein and artery; 20 cc of iodinated protein containing approximately 40 μc of I^{131} were injected into the femoral vein and simultaneous samples of blood and lymph were then collected from the femoral artery and thoracic duct 10, 30, 60, and 120 min later. One group of six animals received radioactive iodinated human albumin and the other group of five animals received canine plasma protein activated with the iodine. The total lymph volume was not measurable so that the exact amount of activated protein that was present in the body lymph could not be calculated. However, it appeared that a negligible amount of the protein was present in the thoracic duct lymph up to 10 min after injection; during the remainder of the first hour a rapid increase occurred, followed later by a more gradual rise.

2591 The Application of Radioactive Iodine to the Study of Thyroidal Physiopathology. E. Azérad. Semaine Hopitaux Paris 26, 155-63(1950) Jan. 14 (in French).

Four radioactive isotopes of iodine (128, 130, 126, 131) are recommended for studying physiologcal problems. The

BIOLOGY AND MEDICINE

experimental technique, fate, and elimination, and the evaluation of use of radioiodine are reviewed. Studies involving the thyroid gland and its mechanism of action, regularly occurring and induced pathological conditions of the thyroid, the diagnostics of thyroid disfunction, and the therapeutics of hyperthyroidism and cancer are mentioned as possible fields for the application of radioiodine techniques; previous work in these fields is briefly discussed. 31 references.

2592 Atomic Physics and Medicine. M. Wolff. Med. Monatsschrift 3, 804-8(1949) Nov. (in German).

This is an elementary treatment of the radioactive phenomena, their applications in medicine, and the medical aspects of the devastations caused by the atomic bomb.

2593 Atomic Science and Phosphate Fertilizers. Giacomo Nicolini. Humus 6, 29(1950)(in Italian).

This is a brief, elementary note on the use of radioactive isotopes in the study of the assimilation of phosphorus by the plant in the presence of fertilizers.

2594 Autoradiography of Water-Soluble Tracers in Histological Sections. F. P. W. Winteringham, A. Harrison, and J. H. Hammond. Nature 165, 149-50 (1950) Jan. 28 (Letter to editor).

A method similar to that of Russell, Sanders, and Bishop (Nature 163, 639(1949)) was used by the authors in determining the location of water-soluble Br^{82} in the larvae of Calliphora erythrocephala. Useful radioautographs were obtained of I^{131} in larvae poisoned by methyl iodide through a combination of the Altmann-Gersh process, and a modified stripping-emulsion technique. Methyl iodide labeled with I^{131} was prepared on a micro-mole scale by exchange with "carrier-free" (I^{131}) in acetone, the solvent being finally precipitated as the bisulfite compound. Larvae were exposed to a concentration of 5 mg/liter of methyl iodide for a period of 18 hr, cooled, placed on paraffin wax, dehydrated, imbedded in the wax, and exposed to the film emulsion as described. High resolution was obtained.

2595 Availability of Isotopes in Biochemistry. Bruno F. Straub. Magyar Kém. Lapja 4, 385-7(1949).

A review of studies in the field of biochemistry performed with isotopes shows, the author claims, that there is a dynamic balance in apparently unchanging cells during the continuous formation and decomposition of ingredients; this balance is disturbed by any excitation and results in observable changes.

2596 Biochemical Analysis. Paul L. Kirk and E. L. Duggan. Anal. Chem. 22, 126-36(1950) Jan.

This is a review of biochemical analysis procedures including isotope tracer techniques and x-ray absorption techniques. 325 references.

2597 The Circulation of Ascitic Fluid; Interchange of Plasma and Ascitic Fluid Protein as Studied by Means of C^{14}-Labeled Lysine in Dogs with Constriction of the Vena Cava. Frank W. McKee, William G. Wilt, Jr., Robert E. Hyatt, and George H. Whipple. J. Exptl. Med. 91, 115-22(1950) Feb. 1.

Radioactive plasma, obtained by withdrawing blood from an anemic and hypoproteinemic dog 24 to 60 hr after C^{14}-

labeled lysine feeding, was injected intraperitoneally or intravenously in dogs presenting experimental ascites; the ascites was produced by giving the experimental dogs 4 days prior to the plasma injection 4 g of NaCl, together with a high protein diet which was maintained throughout the experiment. During the experiment, blood samples were obtained from the animals at intervals. A steady and rather rapid movement of the labeled protein into the circulating blood took place in the intraperitoneally injected dogs. The labeled protein steadily disappeared from the circulating blood fluid and appeared promptly and steadily in the ascitic fluid of the intravenously injected dogs. It is concluded that these experiments emphasize the ready exchange of proteins in the plasma with those in the ascitic pool and vice versa, an exchange which may be called circulation of ascitic protein. 14 references.

2598 A Comparative Study of the Effect of Various Solutions on the Phosphorus Depletion of the Rat Tooth Using Radioactive Phosphorus. Albert E. Jarvis, John E. Christian, Leroy D. Edwards, and Glenn L. Jenkins. J. Am. Pharm. Assoc. 38, 206-10(1949).

Rats injected intraperitoneally with P^{32} were found to have radioactive incisors. A technique is described to study the effect of various solutions on the teeth.

2599 Concentration of I^{131} in Thyroid Cancer Shown by Radioautography; A Study of 100 Consecutive Cases Showing the Relation of Histological Structure to the Function of Thyroid Carcinoma. Patrick J. Fitzgerald, Frank W. Foote, Jr., and R. F. Hill. Cancer 3, 86-105(1950) Jan.

A similar article appeared in J. Clin. Endocrinol. 9, 1153 (1949) under the title The Function of Various Types of Thyroid Carcinoma as Revealed by the Radioautographic Demonstration of Radioactive Iodine (I^{131}), by Patrick J. Fitzgerald and Frank W. Foote, Jr. An abstract was listed in Nuclear Science Abstracts as No. 4-401.

2600 Determination of Total Body Sodium in Man with Radiosodium^{24}. Gilbert B. Forbes and Anne M. Perley. Wash. Univ. Med. Alumni Quart. 13, 61-2 (1950) Jan.

A similar article by the authors was published in J. Lab. Clin. Med. 34, 1599-1600(1949) Nov. An abstract of the article appeared in Nuclear Science Abstracts 4-936.

2601 Historical Sketch of the Biological Application of Tracer Elements. G. Hevesy. In Cold Spring Harbor Symposia on Quantitative Biology. Vol. XIII. pp. 129-50. Cold Spring Harbor, L.I., N.Y., Biological Laboratory, 1948.

This is a complete review of the literature on all aspects of tracers used in biological work since 1912. The author includes a discussion of the earliest biological applications, the importance of deuterium, heavy nitrogen and oxygen as tracers, the application of artificially produced radioisotopes, radioactive tracers in skeletal formation, phosphorus turnover in soft tissues and the turnover of phosphatides and nucleic acids. The uptake and excretion of P^{32} by growing tissue, the application of P^{32} in botanical studies, the applications of radiosulfur and of the radioactive isotopes of extracellular elements, radioiodine, astatine and labeled

alkaline and alkaline earth elements, the applications of labeled erythrocytes, and the applications of C^{11}, C^{13} and C^{14} are also presented. 455 references.

2602 Influence of Camphor and Tetramethylammonium Iodide on the Phosphorus Exchange in Rats and Frogs. G. Ya. Gorodisskaya, M. B. Neĭman, S. I. Rybakova, and R. B. Shnol. Doklady Akad. Nauk S.S.S.R. 69, 833-6(1949)(in Russian).

Using P^{32}, the authors determined the velocity constant of the phosphorus exchange in various organs and tissues of white rats, both in the normal state and under the influence of the convulsion-producing large doses of camphor; they also studied the effect of the paralyzing agent $(CH_3)_4NI$ on the phosphorus metabolism of frogs. The animals were killed at various intervals after the injection of the radioactive P-salt solution alone, or followed (immediately or 15 hr later) by an injection of camphor or $(CH_3)_4NI$. Curves, giving the specific activity as a function of time for various organs, illustrated the accelerating action of camphor on the P exchange: a higher and earlier maximum followed by a steeper decrease, as compared with normal cases; $(CH_3)_4NI$ has an opposite effect of slowing down the P exchange. A criterion of a direct fixation of P from the blood can be derived from the equation of such a direct process, viz. $d\alpha/dt = k(\alpha_1 - \alpha)$, where α_1 and α are, respectively, specific activities of blood and of a given organ, t is the time, and k is the constant of the velocity of the process, 1/k being the mean time τ during which P remains in the organ. The criterion is the following: in the case of a direct fixation, α is maximum when $\alpha = \alpha_1$. The authors experiments showed that in the studied organs P is directly fixed from the blood plasma. The foregoing equation permitted the calculation of k and τ for various organs and tissues. It is found that under the action of camphor the P exchange is accelerated in the brain 17 to 20 times, and in the muscles 5 times; consequently, camphor produces convulsions by the way of the central nervous system.

2603 Iodine: Radioactive and Stable in Normal and Cancerous Tissues. Wm. T. Salter and MacAllister W. Johnston. Trans. Assoc. Am. Physicians 61, 210-35 (1948).

After the administration of I^{131} the concentrations of this isotope and of stable I were determined in various healthy and diseased tissues. The absorption depended on the natural avidity of the tissue for I, the stage of disease or age of the tissue, and the rate of metabolic turnover of the I in the tissue. The normal thyroid was found to store a large quantity of administered I^{131}.

2604 Isotopic Studies of Fixation by Rhizobia in Presence of Hemoprotein. Shirley R. Tove and P. W. Wilson. Proc. Soc. Exptl. Biol. Med. 69, 184-6(1948) Oct.

Atmospheric nitrogen fixation by several species of Rhizobium was tested, in the presence of both positive and negative controls (Azotobacter vinelandii, a species of Clostridium isolated from a soybean nodule, and Alcaligenes radiobacter), through the use of isotopic nitrogen, N^{15}. The Rhizobium samples were incubated with the radioisotope for 48 hr at 24 to 29°C. None of the sterile preparations brought about fixation by the Rhizobia or by mixtures of the Rhizobia and radiobacter; positive results were, however, obtained with Azotobacter and Clostridium.

BIOLOGY AND MEDICINE

2605 Medicine in the Atomic Age. H. L. Pugh. Diplomate 21, 247-54(1949) Nov.

This is a discussion of the effects that the work on radioactivity have had on the field of medicine. Clinical applications in therapeutics and diagnostics and radiation sickness and precautions in radiation work are discussed.

2606 Meeting of the American Society for Pharmacology and Experimental Therapeutics, Inc., Held at Indianapolis, Indiana, Nov. 17 - 19, 1949. J. Pharmacol. Exptl. Therap. 98, 1-37(1950) Jan.

Among the papers presented were the following: The Role of the Gastrointestinal Tract in the Excretion of C^{14}-labeled Methadone by Rats, L. L. Eisenbrandt, T. K. Adler, H. W. Elliott, and I. A. Abdou; Distribution and Excretion of Radioactive Pentobarbital in Rats, J. B. Kahn, Jr.; Studies on the Metabolism of Digitoxin, F. E. Kelsey, E. M. K. Geiling, S. Fishman, L. Gluck, and M. Dahl; The Distribution of Labeled Barbital in the Brain, E. W. Maynert and H. B. van Dyke; Biosynthesis of Radioactive Morphine, B. J. McIntosh, F. E. Kelsey, and E. M. K. Geiling; Character of Blood Changes in Acute Experimental Beryllium Poisoning, H. E. Stokinger, F. A. Smith, C. J. Spiegl, J. K. Scott, and C. A. Stroud.

2607 Meeting of the German Society for Physiological Chemistry and Meeting of Physiologists, Held on Sept. 29 - Oct. 1, 1948, at Frankfurt. Angew. Chem. 61, 251(1949) June (in German).

Among the papers presented at this meeting was: New Results of the Isotopic Method in Intermediary Metabolism, Bernhard.

2608 Metabolism of C^{14}-Labeled Tyrosine and Phenylalanine in Phlorizinized Rats. Dattatreya Rao Sanadi and David M. Greenberg. Arch. Biochem. 25, 257-61 (1950) Feb.

Small amounts of phenylalanine labeled with C^{14} on the β carbon of the side chain were mixed with DL- or L-phenylalanine and injected into phlorizinized rats. The glucose and ketone bodies isolated from the urine contained radioactivity; the total radioactivity in urine and the specific activity of glucose were slightly greater with DL-phenylalanine as the diluent than with L-phenylalanine. In a similar study with β-labeled tyrosine, the total urinary activity and the specific activities of the urinary glucose and ketone bodies were far greater (10-fold or more) with L-tyrosine as the diluent than with DL-tyrosine; one-fourth of the radioactivity of the glucose derived from tyrosine as well as from phenylalanine was located in carbon 6. It is concluded that the β carbons of the side chains of tyrosine and phenylalanine are converted to the α carbon of acetate. (auth)

2609 Observations on the Absorption of Radioactive Strontium and Yttrium by Marine Algae. G. M. Spooner. J. Marine Biol. Assoc. United Kingdom 28, 587-625(1949) Dec.

Tracer experiments to test the absorption of Sr and Y by marine organisms from their environment using Sr^{89}, Sr^{90} and Y^{90} were performed. A discussion of the isotope mixture, chemical effects of the solutions used, decay and recovery, compositions of the solutions used, methods of measurement, and experimental technique are discussed in detail.

BIOLOGY AND MEDICINE

Results from the experiments in several series on red, green, and brown algae are given and discussed extensively. The data is interpreted on the basis of the ionic exchange hypothesis. Sr was extracted in characteristic amounts by the various algae tested, expecially by the brown algae; yttrium is extracted from sea water by green and red algae and to a lesser extent by the brown forms. The authors conclude that extraction of Y is a matter of ionic exchange and surface adsorption, both being important in red algae extraction, the former in brown algae, and the latter in Nitzschia. The authors calculated the true half-life of Y from decay characteristics of mounts of red algae and Ulva; an approximation of 63.4 hr resulted.

2610 Phospholipid Synthesis in Patients with Cirrhosis and Infectious Hepatitis: The Effects of Choline and Methionine as Measured by Radioactive Phosphorus. W. E. Cornatzer and David Cayer. Southern Med. J. 43, 212-17(1950) Mar.

Intramuscular injections of $NaH_2P^{32}O_4$ were given and blood was drawn at 0, 24, 48, and 72 hr in the cases of 16 patients free from any liver disfunction, 10 patients with chronic hepatitis, and 5 with infectious hepatitis, and the results were graphed in terms of the specific activity of the plasma phospholipids. The clinical rationale is discussed in each case and a short discussion is presented on the clinical pathology of hepatitis in terms of the results.

2611 The Possible Applications of Radioisotopes in Medicine. Helmut Vogt. Med. Monatsschr. 3, 567-74 (1949) Aug. (in German).

A short introduction to radioactive phenomena is followed by a survey of the possibilities offered by the latter for applications in medicine. The following are the topics mentioned: radio-autography; use of Geiger counters for the study of metabolism and the processes of resorption, diffusion and excretion; various therapeutic applications of radioisotopes; and the dangers of injuries caused by radiations. 59 references, almost all American. (auth)

2612 Radioactive Iodocasein: Its Action, Fate, and Distribution in the Human. C. F. Hamilton. Collected Papers Mayo Clinic and Foundation 40, 352(1949).

It was shown that more than half the radioactivity of radioiodocasein administered in a case of myxedema appeared in the feces and smaller amounts in the urine both before and after control of the myxedema; much radioactivity was concentrated over the area of the liver. The plasma protein-bound I values were in the euthyroid range 6 and 12 hr after a single dose of iodocasein; after 37 days of treatment, the protein-bound I levels were those usually associated with hyperthyroidism although the patient was in a euthyroid state.

2613 Radioactive Isotopes — An Introduction to Their Properties and Applications to Plant Nutritional Studies. W. D. E. Thomas. In Annual Report of the Agr. and Hort. Res. Station of the Nat. Fruit and Cider Inst., p.118-23. Univ. of Bristol, England, 1948.

A simplified description of atom structure is given, leading to the definition of radioactive isotope. Some of the properties of the principal radiations emitted by radioactive ele-

ments are discussed. The principles underlying the qualitative and quantitative measurement of radioactivity are indicated, and the Geiger Mueller counter method outlined. The application of radioactive tracer technique to plant nutritional studies is illustrated by means of a simple example. (auth)

2614 Radioactive Isotopes in the Study of Intracranial Tumors. B. Selverstone and A. K. Solomon. Trans. Am. Neurol. Assoc. 73, 115-19(1948).

Patients with brain tumors were given intravenous doses of 0.8 to 3.8 mc of phosphate containing P^{32}, and the P^{32} contents of the tumors were determined. It was found that the isotope contents of the tumor tissues were 5.5 to 112 times those of normal white matter of the brain and consistently higher than those of the blood stream; areas of rapid growth showed higher P^{32} concentration than those of lower activity, glioblastomas demonstrating higher concentrations than astrocytomas. The localization and demarcation of subcortical cerebral tumors are being investigated by means of P^{32} uptakes.

2615 Radioactive Studies of the Phosphorus Metabolism of Escherichia Coli. Louis W. Labaw, Vernon M. Mosley, and Ralph W. G. Wyckoff. J. Bact. 59, 251-62(1950) Feb.

The present studies involved the use of P^{32} in determining the phosphorus metabolism and the synthesis of nucleic acids in growing Escherichia coli. The phosphorus uptake was correlated with the number of viable bacteria at points on the growth curve, ranging from the lagphase through the later stationary phases of bacterial growth. For all the experiments P^{32} was introduced to the cultures as Na_2HPO_4 at concentrations sufficient to give the conveniently measurable count of 10^5 disintegrations/min/ml of final culture medium. The technique and procedure employed in these investigations are described. The average phosphorus contents are concluded to be in general agreement with the results of ultraviolet absorption and chemical methods of analysis. The experiments indicated that the measured uptake of phosphorus is not primarily used for buffering, and that phosphorus once taken up by the bacteria does not exchange with the nutrient medium. It was further shown that the uptake and the corresponding cellular multiplication continue through the stationary phase until the onset of logarithmic decay. 1 reference. (auth)

2616 Radioactive Tracers in Agricultural Research. R. Scott Russell. World Crops 1, 77-80(1949) Oct.

The scope and potentialities of the use of radioactive isotopes as a means of tracing the changes which take place in plant nutrition are described and discussed.

2617 Radioisotopes in Agricultural Research in the United States. Philippe Coutiaux. Agriculture No. 105, 223-4(1949) Sept. (in French).

The author describes the agricultural research programs being carried out in various institutions with the aid of radioisotopes. This work may be divided into two parts: the investigation of the effect of radioactive fertilizers on the crop yield and on the growth of plants in general, and the use of tracers in the studies of plant nutrition. The programs described include both types of research. This work is being

carried out at the following institutions: the University of California, the University of Florida, the American Smelting and Refining Co., the State College of Washington, and Purdue University.

2618 Secretion in Cow's Milk of Intravenously Injected Radioactive Phosphorus P^{32}. Max Kleiber, Arthur H. Smith, and N. P. Ralston. Proc. Soc. Exptl. Biol. Med. 69, 354-6(1948) Nov.

The intravenous injection of 15 and 30 mc of P^{32}, respectively, into two lactating cows produced a maximum relative activity per liter of milk of 1.2% of the injected dose at about 5 hr after injection. The relative activity per liter of milk was plotted against the time after injection, and regression equations presented for interpolating the data. A week after the injection, the milk still contained slightly more than 0.1% of the injected P^{32} per liter. Casein with a radioactivity of 2 μc/g was prepared from milk collected during 3 days after injection of 40 mc of P^{32}. A histogram shows the relative rate of P^{32} secretion in milk; in a week, the two cows secreted in their milk 20 and 23%, respectively, of the injected P^{32}. (auth)

2619 The Source of Phosphorus in Bacteriophage. Robert A. Goldwasser. Yale J. Biol. Med. 22, 1-22(1949) Oct.

A nonlysis inhibiting strain of bacteriophage was used to determine the metabolic exchange of P^{32} in the host-parasite relationship. The techniques of study involved differential centrifugation, dialysis, and adsorption of the phage on phage sensitive cells. Three general types of experiments are described in detail: bacteria metabolized in the presence of radiophosphates, especially $KH_2P^{32}O_4$ and $Na_2HP^{32}O_4$, and then grew in the radioactive-free medium infected with phage; nonradioactive bacteria were suspended in a medium containing P^{32} and then infected with the phage; in a third experiment, radioactive bacteria in a radioactive medium were infected with phage. The various fractions were analyzed for P^{32}-containing compounds. The author concludes that the presence of the phage does not influence the adsorption of phosphates by nonmetabolizing bacteria, during the course of phage growth and host lysis, P compounds are formed which are not directly associated with the phage and differ in nature from those found in the normal cell; centrifugation and dialysis are not sufficient methods for phage purification; under conditions where the burst size is small, the source of P in the phage is the bacterial cells previous to their infection. 28 references.

2620 Studies on the Intermediate Metabolism of Tryptophan Labeled with Radioactive Carbon. Dattatreya Rao Sanadi and David M. Greenberg. Arch. Biochem. 25, 323-34(1950) Feb.

Tryptophane labeled with C^{14} in the β position was administered to phlorizinized rats. The glucose excreted in the urine was radioactive. The distribution of the radioactivity in the glucose excreted in the urine, determined by oxidation of phenylglucosotriazole with periodate, suggested to the authors the intermediary formation of a methyl-labeled acetyl derivative from tryptophane; however, there was no radioactivity in the ketone bodies. Intermediary formation of acetate was confirmed by the appearance of the C^{14} in acetyl-p-aminobenzoic acid, hemin, and cholesterol. Analysis of

the proteins of an animal administered the labeled tryptophane showed that tryptophane and dicarboxylic acids accounted for most of the activity; serine had slight activity. The results are discussed. 39 references. (auth)

2621 Studies on the Mechanism of Protein Synthesis with Radioactive Carbon-Labeled Compounds. David M. Greenberg, Felix Friedberg, Martin P. Schulman, and Theodore Winnick. In Cold Spring Harbor Symposia on Quantitative Biology. Vol. XIII. pp. 113-17. Cold Spring Harbor, L.I., N.Y., Biological Laboratory, 1948.

This is a summary of some investigations relating to the problem of the mechanism of protein synthesis by enzymatic reactions, the role of protein synthesis versus degradation in growth and regeneration, and the effects of certain hormones on protein anabolism. The results of experiments on the process of amino acid incorporation into the protein of liver homogenates, the incorporation of C^{14} from glycine-C^{14} into the protein of homogenates of embryonic and newly hatched chick tissue and slices of regenerating liver, the incorporation of S^{35} into tissue slices of regenerating liver, and the effect of testosterone propionate on the incorporation of S^{35} into the muscle tissue and combs of capons are briefly described and discussed. 15 references.

2622 Studies on the Physiology of the Eye Using Tracer Substances. Part III. Further Studies on the Steady-State Ratio of Sodium Between the Plasma and Aqueous Humor in the Guinea Pig and Monkey. Roy O. Scholz. Am. J. Ophthalmology 33, 420-4(1950) Mar.

Male and female guinea pigs and monkeys (Macacus rhesus) were injected intraperitoneally with 0.75 cc/kg of a solution containing about 4.0 mM/cc of radiosodium (Na^{22}) and a radioactivity of 4.0 μc/cc. After 24 hr, the animals were etherized briefly and a sample of aqueous humor was withdrawn and the radioactivity determined. The details of the three individual experiments performed are described. It was determined that the increased osmotic pressure of the tears exposed to drying in the normal guinea pig's eyes does not cause a significant loss of water from the aqueous humor through the cornea. The steady-state ratio, sodium of the plasma water to sodium of the aqueous humor, was found to be 0.977 ± 0.0055 in the guinea pig. The higher concentration of sodium in the aqueous humor, compared with the sodium plasma dialysate in the guinea pig, points to the probability, the author declares, that sodium is secreted from the plasma into the aqueous humor of this species. The steady-state ratio, sodium of the plasma water to sodium of the aqueous humor, was found to be 1.15 ± 0.014 in the monkey.

2623 Tissue Distribution with Time after Single Intravenous Administration of Pentothal Sodium (Sodium Ethyl (1-Methylbutyl) and Pentothal S^{35} Thiobarbiturate). Jesse L. Bollman, Lowell M. Brooks, Eunice V. Flock, and John S. Lundy. Anesthesiology 11, 1-7 (1950) Jan.

Several series of male white rats were given 40 mg of sodium pentothal labeled with S^{35} in 0.2 cc of water into the saphenous vein, the injection taking 30 sec; as much blood as possible was withdrawn by cardiac puncture at a fixed time

(30 sec and 3, 10, 30, 60, or 120 min later) and the other organs were immediately excised, frozen, and analyzed. It was found that the pentothal injected intravenously was rapidly distributed to all tissues of the body; within 30 sec after the completion of the injection most of the drug was out of the blood and was evenly distributed, with few exceptions, in the various organs, the concentration in the brain, muscle, intestine, and lungs being only slightly less than that in the plasma, while the concentration in the liver and kidney was higher. Approximately half of the original concentration of pentothal (30 sec after injection) was present 1 hr afterwards in the tissues. No indication was discovered as to a possible site for the destruction of the pentothal by a specific organ. (auth)

2624 Use of C^{14} in the Study of the Acid Metabolism of Bryophyllum Calycinum. J. E. Varner and R. C. Burrell. Arch. Biochem. 25, 280-7(1950) Feb.

One of the experiments described here consisted of detaching leaves of Bryophyllum, exposing them in the dark to an atmosphere containing $C^{14}O_2$ for definite periods of time and then analyzing them for the C^{14} concentrations of their organic acids, sugars, and starch; malic and citric acids were separated, degraded, and the C^{14} labeling was determined. Comparable experiments involved exposure of the leaves to the radioactive $C^{14}O_2$ (1) in the dark, followed by exposure to light for a short period, or (2) exposure to light and the radioactivity simultaneously, or (3) exposure to the radioactivity in the dark, followed by a residual period of 24 hr in the dark before analysis. It was found that most of the $C^{14}O_2$ fixed by the leaves in the dark was incorporated into the organic acids; starch could be formed from the organic acids in the light, but no evidence was found of this synthesis in the dark. It is concluded that a reversal of the Wood and Werkman reaction seems a more probable explanation of the deacidification of Bryophyllum in the light than either a direct reduction of malic acid to carbohydrate or an oxidation of the malic acid to carbon dioxide followed by carbohydrate formation. 15 references. (auth)

2625 Use of Radioactive Phosphorus to Determine Volume of Blood Replaced in Replacement Transfusion. Robert J. Soberman, Julius R. Krevans, and Richard P. Keating. Proc. Soc. Exptl. Biol. Med. 73, 87-9 (1950) Jan.

Experiments evaluating the usefulness of labeling erythrocytes with P^{32} for the determination of the volume of blood replaced in replacement transfusions on patients with acute leukemia and acute renal failure are presented. Four replacement transfusions were carried out on three patients with acute leukemia and one patient with chronic leukemia. Ten to 15 ml of whole blood were withdrawn in a heparinized syringe from the patient and incubated with 100 μc of P^{32} at 37°C for a period of 2 hr with gentle stirring; the blood was then centrifuged and the sedimented cells were washed twice with saline and resuspended to original volume in saline. An aliquot of the cells was reinjected intravenously into the patient and 15, 30, 60, 90, and 120 min later, samples of blood were withdrawn and tested for radioactivity. Replacement transfusion was then carried out, the amount of blood transfused being 1,075 to 12,500 ml. After the transfusion, blood was again withdrawn after 15, 30, 60, and 120 min. The results showed that there was a difference of 0.9 to 3.9%

BIOLOGY AND MEDICINE

between the amount of replaced blood found by experimental data and that calculated from the mathematical formula described. It is concluded that by the use of the radioactive isotope method, the percentage replacement of blood in replacement transfusion can be satisfactorily determined.

CHEMISTRY

2626 Carbon Isotope Effect on Reaction Rates. Kenneth S. Pitzer. J. Chem. Phys. 17, 1341-2(1949) Dec.

Recent experiments have shown surprisingly large effects of the substitution of C^{13} or C^{14} on reaction rates. Bigeleisen (J. Chem. Phys. 17, 344, 425(1949)) has discussed these results in terms of statistical rate theory. The present author, taking as an example the decarboxylation of malonic and bromomalonic acids, which was investigated by Yankwich and Calvin (J. Chem. Phys. 17, 109(1949)), proposes a simplified model of the molecules of these acids, of bond vibrations and bond breaks; this leads him to values of ratios between the rates of breaking of bonds C^{12}-C^{12} and C^{12}-C^{14}, which are comparable both to those found experimentally and to those calculated by Bigeleisen.

2627 Preparation of Pure Thorium. R. W. M. D'Eye. Atomic Energy Research Establishment Report No. AERE-C/R-425, Nov. 1949. 6p.

Rods of pure, oxygen-free thorium up to 2 mm in diameter have been prepared by the decomposition of thorium tetraiodide on a tungsten wire (0.1 mm diameter) heated electrically to 950° to 1000°C. The melting point of the metal was found to be 1140 ± 20°C. 13 references. (auth)

2628 Automatic Operations in Quantitative Analysis. Gordon D. Patterson, Jr., and M. G. Mellon. Anal. Chem. 22, 136-153(1950) Jan.

Automatic analyses are discussed from the point of view of the individual unit operations involved in any general method of analysis, as applied to the sample and the desired constituent. Inasmuch as the major attempts to automatize industrial analyses have been in the line of measurements of physical properties, greatest emphasis is placed on these developments. Methods using physical properties for automatic measurement are classed under one of the following topics: gravimetry, volumetry, densimetry, manometry, viscometry, magnetometry, titrimetry, calorimetry,chronometry, sonimetry, emissimetry, absorptiometry, thermoconductometry, turbidimetry, refractometry, diffractometry, reflectometry, conductometry, potentiometry, currentimetry, dielectrimetry, and radioactimetry. 566 references (auth)

2629 Chromatography. S. African J. Sci. 46, 181(1950) Jan.

This is a sample description of the chromatographic process for chemical analysis and of some of its uses. Very brief mention is made of its use in rare earth and isotope separation.

2630 Colorimetric Determination of Hydrofluoric Ions. S. Lacroix and M. Labalade. Analyt. Chim. Acta 4, 68-90(1950) Feb. (in French).

A method is described for the colorimetric determination of hydrofluoric ions. It is based on the discoloration of the ferrisulfosalicylic complexes. The action of inhibiting ions, especially of aluminium, has been studied and their separation by distillation with fluosilicic acid has been studied. A new quantitative procedure is proposed, giving results with ± 0.3% of relative error. This method has been applied to the analysis of calcium and aluminium fluorides and of cryolites. (auth)

2631 Determination of Beryllium in Air. Alfred N. Setterlind and Dorothy Geishecker. What's New in Ind. Hyg. (State of Illinois) 6, 4(1949) July-Sept.

The authors report a method for the determination of the concentration of beryllium in air which is a modification of the method described by Fairhall and co-workers utilizing quinizarin-2-sulfonic acid reagent. The modifications involve (1) the use of a different concentration of the quinizarin from that originally recommended, in order to avoid the formation of needle-like crystals in the blank and samples within the time alloted for the stable color development, and (2) the maintenance of a pH of 7.0 in order to assure the proper color development.

2632 Determination of Organic Compounds as Isotopic Derivatives. II. Amino Acids by Paper Chomatographic and Indicator Techniques. Albert S. Keston, Sidney Udenfriend, and Milton Levy. J. Am. Chem. Soc. 72, 748-53(1950) Feb.

A method is described for the estimation of glutamic acid, aspartic acid, hydroxyproline, serine, and threonine in 0.2-1.0 mg of hydrolyzed protein. Paper chromatography is applied to the separation of the p-iodobenzenesulfonyl derivatives formed from the protein hydrolysate products with a reagent containing I^{131}. The recovery is measured by the use of indicators consisting of known p-iodobenzenesulfonyl derivatives containing S^{35} which are added in known amounts immediately after forming the I^{131} derivatives of the amino acids. Radioautograms are used to locate the bands, and constancy of I^{131} to S^{35} ratios in successive portions of the bands provides a test of the validity of the analysis. (auth)

2633 Determination of Oxygen in Titanium. Dean I. Walter. Anal Chem. 22, 297-303(1950) Feb.

Modified vacuum fusion techniques have been employed for the determination of oxygen in titanium. The sample to be analyzed reacts with powdered graphite, in the presence of tin, to form the stable carbide of titanium and reduce the oxides. The evolved gases are extracted and analyzed. With a furnace temperature of 1900°C, complete reduction is effected within 30 min. Good blank conditions are achieved. The analysis of synthetic standards, prepared by diffusing oxygen gas into hot titanium metal, indicates practically complete recovery of oxygen. Analyses have been made on titanium samples which have been prepared by commercial processes. The vacuum apparatus is illustrated and described, and details for the preparation of standard reference samples are given. (auth)

2634 The Influence of Anions on the Morin Test for Aluminium, Gallium, Beryllium, and Zinc, and the Identification of Certain Anions. Edmund Bishop. Analyt. Chim. Acta 4, 6-11(1950) Feb.

The influence of various anions on the morin tests for aluminium, gallium, beryllium, and zinc has been investigated; interfering radicals, which must be removed before

CHEMISTRY

performing the tests, are enumerated; and sensitive tests have been developed for the identification of certain anions capable of removing such cations from solution by precipitation or complex formation. By a combination of four tests, the selectivity of the identification can be increased. Sensitivities are recorded for the detection of citrate, fluoride, oxalate, phosphate, tartrate, and vanadate. A 0.2% solution of morin in 0.01N sodium hydroxide is suggested as a convenient substitute for the usual methanolic solution when the reagent is not in frequent use. (auth)

2635 Measurement of P^{32} in Plant Material by the Use of Briquets. A. J. MacKenzie and L. A. Dean. Anal. Chem. 22, 489-90(1950) Mar. (Note).

A procedure is described for the quantitative determination of the P^{32} activity of plant material by the use of briquets. Radioactivity measurements of the briquetted plant material samples are made by the use of a special holder. The same degree of precision as in the precipitation technique is maintained. The influence of K^{40} is discussed.

2636 Microdetermination of Iodine Employing Radioactive Iodine. M. S. Raben. Anal. Chem. 22, 480-2(1950) Mar.

A method is described for the determination of small amounts of iodine in which the quantifying procedure is a radioactivity measurement. Labeled iodine is produced by the reaction of the unknown in the form of iodate with an excess of radioactive iodide of known specific activity. The iodine is extracted with carbon tetrachloride and the radioactivity in the carbon tetrachloride is determined by γ-ray counting. (auth)

2637 Quantitative Techniques with Carbon 14. William H. Beamer and George J. Atchison. Anal. Chem. 22, 303-6(1950) Feb.

Experimental methods are described which have been developed for use with small amounts of C^{14}-labeled compounds of high specific activity. Techniques are presented for establishing the relationship of weight to radioactivity using 3 to 15 μg of the labeled compound, preparing carbonate samples for counting and using infrared spectrophotometry for the determination of chemical purity of C^{14} compounds. (auth)

2638 A Simple Technique for Semi-Micro Gas Analysis. L. E. J. Roberts and P. C. Davidge. Atomic Energy Research Establishment Report No. AERE-C/R-470, Jan. 1950. 12p.

Volumes of gas ranging from a few cubic mm to 0.5 cc can be analyzed in a simple apparatus, in which the pressure of the gas is measured after compression into a suitable volume, and the gas sample circulated over absorbents in a capillary system. Condensible gases are frozen out in a micro liquid-air trap, O_2 is absorbed by yellow phosphorus, and CO is determined by burning on platinum in a micro silica furnace and condensing the CO_2 formed. The He content of samples containing also N_2, O_2, and CO may be estimated by absorption of these gases on charcoal at liquid nitrogen temperature. A method of analyzing impurities of permanent gases present in CO_2 to the extent of 1 part in 10^5 is described. (auth)

CHEMISTRY

2639 Thorium in Monazite Sand; Separation and Determination by Precipitation from Homogeneous Solution. Hobart H. Willard and Louis Gordon. Anal. Chem. 20, 165-9(1948) Feb.

A new method is described which consists of three steps: (1) Decomposition of the monazite sand with perchloric acid; (2) separation of thorium and the rare earths by hydrolysis of methyl-oxalate in acid solution; and (3) separation of thorium from the rare earths by hydrolysis of urea in the presence of formic acid. The authors consider the method to be accurate and rapid.

2640 Progress Report for October 1 through December 31, 1949. Robert Levine, Lloyd B. Barkley, Martin W. Farrar, and James K. Sneed. NYOO-99, Jan. 2, 1950. 10p.

During the period covered by the present report, progress has been made in the following research projects: (1) a method has been worked out for the preparation of 2,5-dimethylthiophene in reproduceable yields of approximately 60% of theory; (2) this nucleus has been acylated in high yields with acetic, propionic, and n-butyric anhydrides by the boron fluoride etherate method; (3) thianaphthene has been acetylated in the presence of 7 acidic catalysts to give a mixture of 3-acetyl- and 2-acetylthianaphthene; (4) several ketones have been converted to β-diketones containing the trifluoromethyl group; (5) several β-diketones, derived from 2-acetylthiophene, have been prepared; (6) methods have been devised for the preparation of methyl isonicotinate and methyl picolinate in high yields; (7) the former ester has been used to acylate a number of methyl ketones and thus several β-diketones containing the isonicotinoyl group have been prepared.

2641 Preparation of Sulphur, Selenium, and Tellurium Hexafluorides. H. R. Gwinn. Y-568, Feb. 22, 1950. 7p.

Sulfur, selenium, and tellurium hexafluorides were prepared in milligram quantities for isotopic analysis by the mass spectrometer. Fluorination was accomplished by the action of cobalt trifluoride on the element in an evacuated system, which is described briefly. A photograph of the conversion assembly is included. (auth)

2642 Chemistry of Fluorine. H. J. Emeléus. Nature 165, 224-5(1950) Feb. 11.

This article constitutes a review of material presented at a symposium, held on November 30, 1949, by the Chemical Society of the Royal Institution, on fluorine chemistry. This material is discussed under the following headings: anode phenomena in the production of fluorine; preparation and properties of chlorine trifluoride; bromine trifluoride as an ionizing solvent; dissociation energy of the fluorine molecule; rates of reaction of sodium atoms with fluoromethanes; organic fluorine compounds; chemistry of iodotrifluoromethane and iodopentafluoroethane; and trifluoroacetic acid and its derivatives.

2643 The Rearrangement of Chlorofluorocarbons by Aluminum Chloride. William T. Miller, Jr., Edward W. Fager, and Paul H. Griswald. J. Am. Chem. Soc. 72, 705-7(1950) Feb.

Aluminum chloride has been found to cause rearrangement as well as replacement of fluorine by chlorine, when reacting with some saturated chlorofluorocarbons. The rearrangement reaction was shown to proceed by an intramolecular mechanism and to lead to the formation of compounds containing two or three fluorines on one carbon. (auth)

2644 Synthesis of 1:1:1-Trifluoropropyne. R. N. Haszeldine. Nature 165, 152-3(1950) Jan. 28 (Letter to the editor).

Under the influence of ultraviolet light or heat, a reaction between CF_3I and acetylene yields $CF_3CH=CHI$, which is probably capable of polymerization leading, e.g., to $CF_3CH=CHCH=CHI$. The compound $CF_3CH=CHI$ was converted into 1:1:1-trifluoropropyne $CF_3C\equiv CH$, a gas (bp $-48°$) giving various solid metal-derivatives, such as $CF_3C\equiv CAg$. Thus, compounds with a completely fluorinated group adjacent to a reactive triple bond are now available for synthetic work.

2645 A Blood Pipette Shaking Machine. K. C. Parry and G. E. Simmonds. Atomic Energy Research Establishment Report No. AERE-MED/R-432, Oct. 1949. 10p.

An automatic blood pipet shaking machine which can shake up to 6 pipets at once, is simple to operate, silent running, and mains driven, is described in detail. (auth)

2646 Chemistry of Radioactive Substances in Great Britain. Trevor Williams. Rev. Quimica Indústria 12, 14(1949)(in Portuguese).

A brief note on the new laboratories for radio-chemical research at Harwell.

2647 An Experimental Remote Handling Kit for Chemical Work. A. B. Ritchie and W. T. Spragg. Atomic Energy Research Establishment Report No. AERE-C/R-454, Dec. 1949. 5p.

A kit of parts, capable of being rapidly built up into a variety of remote handling devices is described. Tongs with removable jaws, simple ball joints, and a railway for transporting jaws, reagents, apparatus, etc., behind lead screens are described. Possible developments of the equipment are also discussed. (auth)

2648 Scene Photography with Film Fogged by Gamma-Radiation. F. W. Brown, III. AD-190(0). Jan. 11, 1950. 8p.

Films fogged by 50 r and 500 r of Co^{60} γ radiation have been found capable of producing pictures of satisfactory contrast, provided subsequent exposures of the scene are increased by a large factor over normal. (auth)

2649 The Decomposition of Water by Radiation. William J. Toulis. UCRL-583, Feb. 10, 1950. 44p.

In order to account for the observed decomposition of water by radiation (i.e., x-rays protons, α particles, extreme ultra-violet, etc.), it has been suggested that the primary effect of the irradiation of water is the creation of H-atoms and OH-free radicals. A general analysis of the problem indicates that the decomposition of water is dependent on (1) the rate of energy loss of the radiation, (2) the rate of diffusion, (3) the interaction of the decomposition

products with the H and OH free radicals, (4) the probability of capture while in a solvent cage, and (5) the purity of water. The decomposition of air-free water by radiation falls, essentially, into two groups. In one group the decomposition of water is large with the result that the number of H_2 and H_2O_2 molecules is almost equal to the number of ion pairs created by the radiation. This group is characterized by only that type of radiation in which the rate of energy loss is greater than 70 Mev/gm/cm^2 of water. This corresponds to energies less than 6 Mev for protons and 125 Mev for α particles. The second group includes all radiation with a lower rate of energy loss and is characterized by a total decomposition which is small and difficult to evaluate since minute impurities in the water introduce additional complicating factors. In order to determine the detailed mechanisms that control the decomposition of water, it became necessary to study the influence of O_2, H_2, and H_2O_2 on the decomposition of water: (1) O_2 has a high affinity for H-atoms and, therefore, its presence prevents a recombination of the H and OH free radicals; (2) the effect of H_2 in an O_2 aqueous solution is to eliminate the interaction of OH and HO_2 and, therefore, enhance the formation of H_2O_2; (3) the effect of H_2 on a H_2O_2 aqueous solution, on the other hand, is to enhance the decomposition of H_2O_2. Thus from these and other experiments it was possible to determine the influence of H, OH, and HO_2 free radicals in the decomposition of water. The most distinctive feature for any of the free radical reactions, however, was the probability of capture while in the solvent cage. Once this factor has been determined, then the range and lifetime of the radicals can be calculated for any given set of conditions. The probability of capture while in the solvent cage depends on the type of interaction; radical-radical interactions have a probability which is close to unity while radical-molecule interaction probabilities may be as small as 10^{-6} and depend mostly on the type of radical rather than the molecule. Among the free radicals, the H-atom is predominately active, mainly, because of its relatively simple structure and its ability to diffuse rapidly. The OH is next with the HO_2 being the least active of the three. 28 references. (auth)

2650 Contribution to the Study of Polymerizations Induced by Nuclear Radiations. A. Chapiro, Ch. Cousin, Y. Lander, and M. Magat. Rec. trav. chim. 68, 1037-68(1949) Dec. (in French).

Various monomers (butadiene, styrene, acrylonitrile, methyl methacrylate, and vinyl acetate) were irradiated with slow neutrons and with γ rays. The rates of polymerization were investigated, as were also the relative contributions to the process by the primary Szilard-Chalmers effect and by the secondary effects of disintegration γ's and β's and expelled atoms. Addition of various organic compounds usually increased the rate of polymerization. Possible kinetic mechanisms are suggested. First results with β-ray and x-ray irradiation were similar to those obtained with neutrons and γ rays.

2651 Activation Analysis of the Rare Earths. H. W. Kohn and E. R. Tompkins. ORNL-390, Nov. 30, 1949. 14p.

Thermal neutron activation methods have been applied to the analysis of rare earths for contamination by other rare earths. The procedure used was first to irradiate a small

amount of the material in the Clinton Reactor for from 1 to 5 min. when the short irradiation method was used and from 16 hr to 1 week for the long method, then to spread a thin film of the oxide on scotch tape placed across a hole in an aluminum card, cover the sample, and count in a bell type Geiger counter. By this procedure the presence of 0.63% samarium in cerium, 1.18% dysprosium in yttrium, 0.023% neodymium and 0.01% cerium in praseodymium, and 0.03-0.3% cerium in lanthanum, and the purity of scandium have been determined. Mathematical relationships for use in these experimental procedures have been derived.

2652 The Preparation of Uridylic and Cytidylic Acids from Yeast Ribonucleic Acid by an Ion-Exchange Method. W. E. Cohn and C. E. Carter. ORNL-377, Oct. 12, 1949. 11p.

The preparation of uridylic and cytidylic acids from an acid hydrolysate of yeast ribonucleic acid by employing the anion exchanger Amberlite IRA-400 and elution with formic and hydrochloric acids is described. From 100 g of nucleic acid, 4.9 g of crystalline diammonium uridylate were obtained in a preparation involving formic acid elution and conversion of uridylic acid to the diammonium salt. In another preparation, employing a hydrochloric acid elution, 17.8 g of a barium uridylate fraction were obtained which, by spectrophotometric assay, contained 52% (9.25 g) uridylic acid. A method for conversion of barium uridylate to free uridylic acid employing a cation exchange technique is described. Cytidylic acid was readily crystallized from fractions eluted from the column in either dilute formic or hydrochloric acid. The yield was 7.5 and 6.9 g, respectively, from 100 g of yeast ribonucleic acid. (auth)

2653 The Isolation and Characterization of Spleen Ribonucleic Acid. Elliot Volkin and Charles E. Carter. ORNL-587, Mar. 1, 1950. 19p.

A new method of preparation of ribonucleic acids from mammalian tissue involving their precipitation by 4M guanidine hydrochloride is described. By use of this method, a purified, essentially homogeneous ribonucleic acid has been prepared from calf spleen in the analytical ultracentrifuge. Under the conditions employed the product exhibited a sedimentation constant of 3.09 S. The composition of the spleen ribonucleic acid, determined by ion-exchange analysis of the constituent mononucleotides, was found to be 28% cytidylic acid, 24% adenylic acid, 14% uridylic acid, and 34% guanylic acid. The enzymatic degradation of spleen ribonucleic acid by crystalline ribonuclease liberated a total of 1.5×10^{-6} equivalents of H^+ ions per milligram of nucleic acid. 17 references. (auth)

2654 The Separation of Adenosine Polyphosphates by Ion Exchange and Paper Chromatography. Waldo E. Cohn and C. E. Carter. ORNL-610, Mar. 17, 1950. 9p.

Ion exchange and paper chromatography techniques have been applied to the separation of adenosine triphosphate and adenosine diphosphate from each other and from adenine, adenosine, and adenylic acid. Good agreement in analyzing knowns was obtained with both techniques. However, ion-exchange analysis is inherently a more sensitive and rigorous technique than paper chromatography and permits a wider

variation in concentrations of components to be separated. Paper chromatography appears to be most useful when a rapid, semiquantitative technique for the analysis of a large number of samples is desired. The ion-exchange separation may be used as a preparative method.

2655 Preparation of p-Dimethylaminoazobenzene Containing Isotopic Carbon in the Dimethylamino Group. William S. Fones and Julius White. J. Natl. Cancer Inst. 10, 663-4(1949) Dec.

p-Dimethylaminoazobenzene containing C^{13} in the dimethylamino group has been prepared by the methylation of methylaniline with C^{13}-methyl iodide followed by coupling of the resulting dimethylaniline with diazotized aniline.

2656 Steroids Labeled with Isotopic Carbon: Cholestenone and Testosterone. Richard B. Turner. J. Am. Chem. Soc. 72, 579-85(1950) Jan. (See also NSA 3-288.)

Two methods have been devised for the introduction of isotopic carbon in ring A of steroids. The best procedure involves condensation of an unsaturated ring A lactone with phenyl acetate and has been applied to syntheses of cholestenone-3-C^{14}, testosterone-3-C^{14}, testosterone-4-C^{14}, and testosterone-4-C^{14}. (auth)

2657 Synthesis of Cystine. Edward M. Fry. J. Org. Chem. 15, 438-47(1950) Mar.

Two syntheses of cystine are presented. One is a modification of an old method and the other depends on the rearrangement of an oxazoline salt. Both are designed for the use of isotopic sulfur. (auth)

2658 A Formate-Carbonate Exchange Reaction Revealed by "Labeled" Carbon. D. G. Grant and H. S. Turner. Nature 165, 153-4(1950) Jan. 28 (Letter to the editor).

The preparation of formates was examined as part of a program for the development of reliable syntheses of labeled organic compounds. Nearly quantitative yields of formate are obtained by the hydrolysis of aqueous solutions of potassium cyanide at 175° for 2 hr. Potassium carbonate, always present (up to 25%) in commercial KCN, does not affect the yield of formate, but the labeled carbon is found to have become distributed between the formate and the carbonate. It is necessary to precipitate and remove the carbonate before hydrolysis. Furthermore, special experiments, both with mixtures of Na_2CO_3 and C^{13}-labeled sodium formate, and with mixtures of HCOONa and C^{14}-labeled sodium carbonate, revealed an exchange formate-carbonate reaction, possibly involving the oxalate ion. The extent of the exchange appears to offer a route to labeled formate which may have implications in other fields.

2659 Study on the Mechanism of Ionic Polymerization with the Aid of Radioactive Indicators. Yvan Landler. Rec. trav. chim. 68, 992-8(1949)(in French).

This is a study of the mechanism of the reaction of polymerization of organic ions, charged either positively or negatively, in the presence of catalysts. The example of a cationic polymerization described is that of styrolene with the aid of $SnBr_4$, while the polymerization of methyl methacrylate in the presence of Grignard's solution represented

CHEMISTRY

in the anionic type. In both cases the catalyst contained radioactive Br that permitted the establishing of the fact that in the final stage of the reaction the catalyst remains in, at least, one part of the polymerized molecules. Thus, ~ ⅓ of all polymerized styrolene molecules (mean molecular weight 46,000) contained each one molecule of $SnBr_4$, while > ½ of polymerized methyl methacrylate (mean molecular weight 20,000) contained the elements of Grignard's compound.

2660 Determination of Zirconium in the Presence of Uranium; A Spectrophotometric Method. Ruth Guenther and Richard H. Gale. KAPL-305, Mar. 10, 1950. 9p.

The formation of the zirconium-alizarin lake by the interaction of zirconyl and alizarin sulfonate ions and the measurement of absorbency of the lake have been investigated. A modified procedure, based on the method of Green, (Anal. Chem. 20, 371(1948)) has been evolved for the determination of zirconium in uranium-zirconium alloys. The modification permits the determination of zirconium in a 2000-fold excess of uranium. Some experimental data are included.

2661 A Rapid Determination of Uranium. Robert Rasin-Streden. Analyt. Chim. Acta 4, 94-106(1950) Feb.

A photometric method for the determination of uranium has been described, based on a reaction published by O. Hackl (Z. Anal. Chem. 119, 321(1940)), i.e., the yellow coloration given to a solution of an uranyl salt in an excess of sodium carbonate by H_2O_2. The conditions and properties of this coloration have been investigated; the coloration complies with Beer's Law and is not interfered with generally, except by vanadium, appreciably large amounts of chromium and a bulk of aluminum, which involve a change of the procedure. This photometric method has been examined thoroughly for more than two years and a great number of samples have been analyzed. The results closely checked those obtained by gravimetric analyses. The method covers a wide range (from 0.2 up to 85% U_3O_8), the average error is not exceeding 2 or 3 parts in 100. An outstanding feature is the versatility and simplicity of performance and the short time (20 to 90 min) required, which make it especially suitable for routine analyses. (auth)

2662 Study of the Fluorescence of Uranium Solutions with Meunier's Electro-Fluorometer. A. Boutaric and C. Maraux. Bull. Soc. Chim. France, 952-6(1948) Sept.-Oct. (in French).

A description of the apparatus is given. It is used for fluorescence measurement of uranium solutions. If the fluorescence of a standard is F_0 and the fluorescence of the unknown substance is F, then the intensity of fluorescence is $\log_{10} F/F_0$. The fluorescence depends on the concentration. At 0.30 g per liter a maximum is obtained. The influence of the pH is studied with 0.05% uranium solutions with buffers using the Sorenson, Clark, Lubs method. The fluorescence increases with the pH (starting with 5.28) until approximately pH 8 and then decreases fairly rapidly. The influence of the addition of potassium iodide (0.5-3%), novocaine, and several other organic and inorganic inhibitors to uranium solutions is investigated.

CHEMISTRY

2663 Uranium Carbides: Their Preparation, Structure, and Hydrolysis. Lawrence M. Litz. In Abstracts of Dissertations, Spring Quarter 1947-48, p.131-37. Ohio State Univ., 1949.

It was found that finely divided uranium metal would react with methane at temperatures as low as 625°C to produce a carbide which was identified as the monocarbide, UC. Previously only UC_2 had been reported in the literature. By reacting uranium metal with graphite at 2100°C, well defined metallic crystals of UC were produced. By increasing the temperature to approximately 2400°C, crystals of UC_2 were obtained. The x-ray diffraction pattern obtained by the Debye-Sherrer photographic method indicated that the crystal structure of UC is face-centered cubic with $a_0 = 4.955$A. The Debye-Sherrer films showed that UC has the NaCl structure, and UC_2 has the CaC_2 structure. Intensity measurements with an x-ray spectrometer confirmed these results. The uranium carbides give widely different hydrolysis products with varying temperatures. Below 100°C the gaseous products are chiefly hydrocarbons. Above 100°C the concentration of hydrocarbons decreases and the amount of hydrogen increases until, at temperatures above 300°C, the gaseous product is almost pure hydrogen. When acetylene was added to the system during hydrolysis, the nascent hydrogen was effective in hydrogenating acetylene, a reaction which did not take place in the presence of molecular hydrogen. The rate of reaction of the uranium carbides with halogens was found to vary in the order $BrCl > Br_2 > I_2$. In no case was there any organic halide produced.

2664 Vanadametry. Part V. Volumetric Estimation of Uranium with Sodium Vanadate. M. Narasimhasastri and G. Gopala Rao. Current Sci. 18, 402-3(1949) Nov. (Letter to the editor).

An over-all concentration of 0.01N oxalic acid has been found effective in overcoming the difficulty of the slowness of the end point in the titration of U^{+4} with sodium vanadate when diphenyl benzidine is used as indicator.

ENGINEERING

2665 Geiger-Mueller Tubes in Industrial Radiography. O. J. Russell. Electronic Eng. 22, 94-8(1950) Mar.

The Geiger counter, although it does not replace photographic plates in radiographic applications, has many useful applications in this field. It may be used as an exposure meter to determine correct exposure times, or may, in some cases, be used to scan the area behind the target in place of a photographic plate. Special problems arising in x-ray and γ radiography with counters are discussed. In radiography of homogeneous substances, a differential scanning system may be used to detect flaws. Two counters detect radiation passing through two closely spaced sections of the target and their outputs are compared. In the absence of a flaw these outputs should be equal, and will give a null reading when fed into a balancing circuit. Other special scanning methods are described. The author also describes a counter specially designed for mapping x-ray diffraction patterns.

MINERALOGY, METALLURGY AND CERAMICS

2666 The Effect of Molten Bismuth on Insulating Materials. W. S. Fleshman and C. G. Collins. NEPA-1306, Feb. 9, 1950. 16p.

Samples of 26 Johns-Manville insulating materials, which included cements, bonded fibrous blocks, and fire bricks, were tested for possible reaction with molten bismuth. The tests consisted essentially of pouring molten bismuth at 1832°F (1000°C) over insulation maintained both at room temperature and at 1832°F (1000°C), although some tests were made in which the insulation was heated together with the bismuth for periods up to 3 hr. In general, the results indicated that little or no reaction, particularly of an explosive nature, occurred when the molten bismuth came into contact with the unheated materials, and that none of the materials would withstand contact with the bismuth when both were at 1832°F (1000°C) for more than a few hours. Greatest resistance to bismuth attack was shown by 3 types of asbestos millboards. (auth)

2667 On the Determination of the Absolute Geologic Age by the Helium Method, Using Non-Radioactive Minerals of Close Crystalline Packing. V. G. Khlopin. Doklady Akad. Nauk S.S.S.R. 69, 825-8(1949) (in Russian)

Gerling (Doklady Akad. Nauk S.S.S.R. 24, No. 3 and 6 (1939)) has shown that in minerals with a closely packed crystalline structure the leakage of He during geologic time is negligibly small. This furnished a convenient method for the determination of the geologic age of rocks by recurring to many non-radioactive minerals (Gerling and Polkanov, Izvest. Akad. Nauk S.S.S.R., Ser. Geolog. No. 2, 29(1946)). However, it has been found that in many minerals containing Li, Be, or B, the He content exceeds considerably that corresponding to the mineral's true age. The excess has been attributed by the author (Doklady Akad. Nauk S.S.S.R. 66, No. 5 (1949)) to the occlusion of He (both He^4 and He^3) during the crystallization of those minerals from the magma. This circumstance necessitates, before using the He method for age determinations, a test ascertaining that the content ratio He^3/He^4 is less than 2×10^{-8}. In the present note the author points out that, under the occlusion hypothesis, there are no physico-chemical considerations that should limit the studied phenomenon to Li, Be, and B minerals; accordingly, the same fact of excessive He content should be generally observed with minerals of closely packed crystalline structure. Following the author's suggestion, Cherdyntsev and Kozak (Doklady Akad. Nauk S.S.S.R. 69, 829(1949)) tested this conclusion and proved its validity. Furthermore, in the author's opinion, the He occlusion from the magma may take place only in definite temperature phases of solidification, and only in magmas of a certain composition. He, therefore, suggests research in the directions thus outlined. If such a discrimination between He-containing minerals of various magmatic history can be established, the He method of age determination will resume its original simplicity.

2668 On the Origin of the Excess in the Helium Content of Certain Minerals. V. V. Cherdyntsev and L. V. Kozak. Doklady Akad. Nauk S.S.S.R. 69, 829-32 (1949)(in Russian).

The amount of He in certain minerals, containing Li, Be, or B, exceeds that which can be accounted for by radioactive processes that may have taken place since the crystallization of the corresponding rock formation. The excess may reach 7×10^{-2} cm³/g. The only plausible explanation involves occlusion of He from the magmatic liquid during the crystallization, and the subsequent retention of He in minerals of

closely packed crystalline structure (Gerling and Polkanov, Izvest. Akad. Nauk S.S.S.R., Ser. Geol. No. 2, 29(1946)). In the present work, minerals of pegmatites from many sites were analyzed for He content, viz., beryls and minerals paragenetically related to them, such as rutile, cassiterite, garnet, topaz, cleavelandite, pollucite, lepidolite, quartz, and albite. The He content in beryls depends on the crystallization temperature of the corresponding pegmatite; thus beryls from the high-temperature microcline-quartz pegmatites contain, on the average, 2.31×10^{-3} cm³/g He, from the middle-temperature greisens 1.12×10^{-3} cm³/g, and from the low-temperature albite pegmatites 0.3×10^{-3} cm³/g. Beryls from pneumatolytic veins, which fixed the volatile components of the cooling magma, contain 1.03×10^{-3} cm³/g He. Among the other minerals examined, certain cassiterites, topaz, garnets, and rutile have high He contents, comparable to those in beryls. A magnetite crystal from a recent volcanic bomb of an active volcano in Kamchatka contained 2.6×10^{-5} cm³/g He, an amount that, if uncritically employed for the computation of age, would give 500 million years.

2669 Effect of Nuclear Reactor Radiation on Metals. D. S. Billington and Sidney Siegel. AECD-2810, nd, Decl. Mar. 22, 1950. 30p.

Experimental evidence for changes in the properties of metals, produced by exposure to nuclear reactor radiation (neutrons, γ radiation, β particles) is presented. The properties investigated include density, electrical resistivity, hardness, and elastic modulus. In all cases except those of simple light metals changes were observed, differing widely in magnitude depending on the nature and metallurgical state of the material. The materials investigated include Al, Cu-Au, and Cu-Be alloys, and stainless steel. (auth)

2670 Progress Report for October, November, and December 1949. R. Smoluchowski. CAR-6, Jan. 10, 1950. 6p.

Investigations of the diffusion of silver along grain boundaries of columnar copper in diffusion couples of columnar copper and copper containing 4% silver are described. A relationship has been found to exist between diffusion and orientation of grains and grain boundary. Polycrystals (tri- and quadri-) of pure copper are being made for use in preparing foils for grain boundary diffusion studies with Ag^{110} as a radioactive tracer. Small angle and continuous pole figure cameras in operation are discussed briefly.

2671 Melting and Refining of Relatively High Purity Nickel. Victor F. Zackay and Frank P. Kershaw. COO-6, Jan. 1950. 18p.

A laboratory type vacuum induction furnace and a casting furnace, both of which can be evacuated or operated with any desired atmosphere, were constructed; and techniques were developed for refining and casting ingots of relatively high purity nickel (99.944%). The refining procedure effectively removed or neutralized the adverse effects of carbon, oxygen, and sulfur. Carbon in small amounts was found to expand the lattice parameter equivalent to several per cent of the usual metallic alloying element. It was removed as carbon monoxide by adding nickelous oxide to the melt. The oxygen which was present primarily as oxide inclusions was eliminated by a hydrogen treatment. The sulfur in the form of the grain boundary precipitate nickel sulfide was effectively dispersed as intracrystalline inclusions of magnesium sulfide. Careful control of casting practices with regulation of such factors

as temperature and rate of pouring, maintenance of inert atmosphere in all melting operations, and the utilization of vacuum in the actual pouring and casting resulted in ingots of excellent surface quality and reproducible micro and macro structures. The apparatus and techniques developed for pure nickel lend themselves readily to the fabrication of any of its alloys.

2672 Development of Zirconium-Base Alloys. R. W. Hennig and J. D. Nisbet. GEZR-1, Jan. 3, 1949. 6p.

A program has been undertaken to develop zirconium-base alloys for possible application in the field of atomic energy. This shall consist of the melting and casting of specific alloys, the physical testing of these metals, and the evaluation of test results. This first monthly report covers the first phase of the program—the development of equipment necessary for melting zirconium and zirconium base alloys. An arc furnace has been designed and is in the process of being built. The melting will be carried out in a water-cooled, hemisphere-shaped, copper crucible and cast centrifugally in a metal mold located above the sides of the crucible.

2673 New Cobalt-Base Alloy for High-Temperature Sheet. W. O. Binder and H. R. Spendelow, Jr. Metal Progress 57, 321-6(1950) Mar.

A superior high-alloy sheet, for use at temperatures up to 1800°F, has been based on cobalt (50%), chromium, nickel, and tungsten. While strong and stiff, it can be readily formed in bending, stamping, and drawing, has good weldability, and high resistance to oxidation. To develop optimum properties a short heating at 2200°F, followed by air cooling, is all that is necessary. Five graphs and three tables are included. (auth)

2674 The Creep Strength at 200°C. of Some Magnesium Alloys Containing Cerium. G. A. Mellor and R. W. Ridley. J. Inst. Metals 75, 679-92(1949) Apr.

A number of alloys of magnesium containing cerium or "mischmetall" (a mixture of rare earth elements in which cerium predominates), with or without additions of manganese, were tested in creep at 200°C under a stress of 2 tons/in.^{2} and the conditions: (1) as cast, (2) as rolled, and (3) as rolled and heat-treated. It was found that under these particular conditions of testing little advantage is gained by increasing the cerium content beyond 1½ or 2%, and that rolled alloys are markedly inferior to cast alloys unless they are solution treated, when they become as strong as the cast material. Some slight age-hardening was found to take place in alloys containing from 0.5 to 6% of cerium, and the creep resistance appears to be associated with this phenomenon. Cerium in the form of a eutectic network, or as coarse particles precipitated at 250°C or at higher temperatures, does not contribute to the strength of the alloy in creep at 200°C. (auth)

2675 Effects of Three Interstitial Solutes (Nitrogen, Oxygen, and Carbon) on the Mechanical Properties of High-purity, Alpha Titanium. Walter L. Finlay and John A. Snyder. J. Metals 188, 277-86(1950) Feb.

The effects of three interstitial solutes—nitrogen, oxygen, and carbon—on the mechanical properties of high-purity α titanium were determined on fusion-alloyed, annealed specimens in comparison with a substitutional solute, iron. A good correlation between bend ductility as well as the several microtensile properties and Vickers hardness was established for both the binary and ternary alloys of the interstitial solutes. In contrast to substitutional solutes, it was shown that the element with the lowest solubility had the greatest strengthening effect and this was discussed relative to the associated lattice parameter changes. Several graphs and photomicrographs are included. (auth)

MINERALOGY, METALLURGY AND CERAMICS

2676 A Method of Examination of Sections of Fine Powder Particles with the Electron Microscope. Laurence Delisle. Mikroskopie 4, 5-16(1949).

This article appeared also in J. Metals 1, 228(1949) and was abstracted in Nuclear Science Abstracts as No. 4-173.

2677 Titanium and Zirconium in the Anglo-American Literature in 1949. O. Kubaschewski. Z. Metallkunde 40, 460-2(1949) Dec. (in German).

This review article summarizes the results of investigations of titanium and zirconium as published in the British and American literature in 1949. 24 references are given.

2678 Spectroscopic Determination of Uranium in Minerals. Alfredo L. Mercader and Efrain Pezo Benavente. Anales asoc. quim. argentina 37, 235-45(1949)(in Spanish).

An attempt was made to use the spectrographic analysis for the quantitative determination of uranium in ores whose U content does not exceed 1%. The authors followed the procedure described by Strock (Spectrum Analysis with the Carbon Arc Cathode Layer. London, Hilger Ltd., 1936), the correction for background being made according to Scott (J. Soc. Chem. Ind. (London) 25, 63(1944)). Molybdenum was used as a standard. The ore examined, from Mendoza Province, Argentina, was found to contain 0.77% U; this is a mean of eight analyses, the mean deviation being about 8%.

2679 Radiocalcium to Study the Distribution of Calcium Between Molten Slags and Iron Saturated with Carbon. W. O. Philbrook, Kenneth M. Goldman, and Martha M. Helzel. J. Metals 188, 361-7(1950) Feb.

Radioactive calcium has been used to learn whether calcium can be detected in iron saturated with carbon after it has been melted under CaO-Al_2O_3-SiO_2 slags similar to those used in the iron blast furnace. It was hoped that the radioactive tracer technique might make possible a general study of steelmaking reactions in which calcium or calcium oxide are involved. No calcium could be found in the metal under conditions which were favorable for the reduction of calcium, and it has been concluded that the calcium content of the iron was less than 6×10^{-5}%. Some of the problems encountered have been instructive with regard to pitfalls and limitations of tracer methods. (auth)

PHYSICS

2680 Summary of the Research Progress Meeting of February 2, 1950. H. P. Kramer. UCRL-598, Feb. 15, 1950. 10p.

Research on the following topics is discussed: stability of gaseous metallic oxides; neutron-deuteron scattering with 90-Mev neutrons; theoretical aspects of neutron-deuteron scattering.

PHYSICS

2681 Summary of the Research Progress Meeting of January 26, 1950. H. P. Kramer. UCRL-601, Feb. 13, 1950. 11p.

Research on the following topics is discussed: Effects of radiation and tumors on nucleic acid metabolism; vapor phase hydrolysis of lanthanum chloride; observation of π mesons from proton-proton collisions.

2682 Summary of the Research Progress Meeting of February 9, 1950. Henry P. Kramer. UCRL-609, Feb. 27, 1950. 7p.

Research on the following topics is discussed: search for double β decay; 350-Mev proton elastic scattering; development of pulsed scintillation counters.

2683 Summary of the Research Progress Meeting of February 16, 1950. H. P. Kramer. UCRL-618, Feb. 27, 1950. 7p.

Research in the following topics is discussed: delayed α-emitters (emission of α particles from a daughter of a primary excited nucleus in such a manner that the decay time of the intermediate stage is extremely short); new technique of growing stilbene crystals; neutron deficient isotopes of strontium (Sr^{81}, Sr^{82}, and Sr^{83}).

2684 Interpretation of Bikini Magnetic Data. L. R. Alldredge and W. J. Dichtel. Trans. Am. Geophys. Union 30, 831-5(1949) Dec.

A detailed magnetic field total intensity contour map of Bikini Atoll (Alldredge and Keller, Trans. Am. Geophys. Union 30, 494-500(1949)) is interpreted in a magnetic model study. It is indicated that basement material rises to within 5000 ft of sea level approximately one mile to the northeast of Bikini Island. The model assumes uniform susceptibility and zero permanent magnetization and conforms to known seismic profiles of the basement.

2685 Measurement of the Earth's Magnetic Field at High Altitudes at White Sands, New Mexico. S. F. Singer, E. Maple, and W. A. Bowen, Jr. Phys. Rev. 77, 398-9(1950) Feb. 1 (Letter to the editor).

An Aerobee (Van Allen et al, Science 108, 746(1948)) rocket containing a total field magnetometer was fired at the White Sands Proving Ground, New Mexico (geomagnetic latitude 41° North) on April 13, 1948, at 1441 MST. The rocket reached a height of 372,000 ft (114 km) above sea level. Telemetered data gave the value of the earth's magnetic field during flight. The magnetometer measured the sum of the squares of three perpendicular components of the field so as to give an output independent of its orientation. It was found that the field strength decreased with altitude in accordance with calculations based on potential theory. No evidence could be obtained either for or against the existence of circulating current sheets in the upper layers of the atmosphere in view of the smallness of the expected effect at the latitude of the experiment.

2686 The "1947 Values" of the Atomic Constants and the Revision of the Faraday Constant. Jesse W. M. DuMond. Phys. Rev. 77, 411(1950) Feb. 1 (Letter to the editor).

The two precision determinations of the Faraday by electrochemical methods, (1) by the silver voltameter (Vinal, Compt. rend. 3, 95(1932)) and (2) by the iodine voltameter (Vinal and Bates, Bull. Bur. Stand. 10, 425(1914)), fail to agree by considerably more than their estimated probable errors warrant. The value obtained by the first type of measurement has long been accepted, partly because it has been regarded as correct by definition. The author believes that it would be more desirable to define this constant as the quantity of charge associated with one gram atomic weight of singly ionized atoms. This quantity has recently been measured precisely at the National Bureau of Standards (Hipple et al, Phys. Rev. 76, 1877(1949)). The value of the constant so defined would be $F = 9652.8 \pm 0.8$ emu/g (physical scale), a value closer to the iodine Faraday than to the silver Faraday. The difference between the two values is attributed by the author to the isotopic composition of silver. Further evidence is cited for the adoption of a revised value of the Faraday.

2687 The Structure of Atoms from Diffraction Studies. H. Hauptman and J. Karle. Phys. Rev. 77, 491-9 (1950) Feb. 15.

A method is given for obtaining the electron distribution in atoms from diffraction data which makes use of the fact that the distribution function is positive. The property of positiveness affords a basis for extrapolating the scattering data which are determined experimentally over only a finite range. This extrapolation is needed since the formula relating the electron distribution to the scattering function requires that the latter be known over an infinite range. A procedure for the extrapolation is given and the nature of the error is discussed. (auth)

2688 Thorium Compound Protective Coating for Reflecting Surfaces. Glenn L. Dimmick (to Radio Corporation of America, New York). Canadian Patent 461,483, Nov. 29, 1949.

A mirror is described which consists of an adherent covering over a glass base, a specular reflecting layer upon the adherent material, and a transparent layer of protecting material deposited on the reflecting material. The adherent layer and the protective material consist of a compound, $ThF_4.H_2O$, formed by heating thorium and fluorine at red heat in an inert atmosphere, while the reflective surface consists of metallic aluminum. The thorium compound protects the mirror reflecting surface from corrosion and abrasion and is of a thickness at least of the order of one-quarter of the wavelength of the light to be reflected.

2689 On the Abundance of C^{13} in the Solar Atmosphere. J. L. Greenstein, R. S. Richardson, and M. Schwarzschild. Pubs. Astron. Soc. Pacific 62, 15-18(1950) Feb.

The relative abundance of C^{13} and C^{12} in the solar atmosphere has been determined by measurements of the width of isotope doublets in the cyanogen band at λ 3883. Although it was impossible to make an exact determination, it was possible to conclude that this ratio is less than $\frac{1}{30}$. This value approaches the terrestrial value 1:90 and is much less than the isotope ratio $\frac{1}{5}$ tentatively indicated for the core of the sun according to the available estimates of the nuclear cross sections involved in the carbon cycle. It seems necessary to assume either that one of the experimental cross sections is greatly in error, or that the elements in the sun are not well mixed from core to atmosphere.

PHYSICS

2690 Directional Measurements of the Diurnal Variation of Cosmic-Ray Intensity. H. Elliott and D. W. N. Dolbear. Proc. Phys. Soc. (London) 63, 137-44(1950) Feb. 1.

Measurements of the solar daily variation in cosmic-ray intensity have been made for a total of 360 days using two arrays of Geiger-Mueller counters inclined at 45 deg to the vertical in the North and South directions. Both the diurnal and semi-diurnal variations are found to be significantly different for the two directions, and since the particles recorded by the two sets have passed through the same amount of atmosphere under similar conditions, it must be supposed that at least a part of the variation is due to causes which lie outside the earth's atmosphere. It is found that both the amplitude and phase of the daily variation for the South-pointing recorder vary with season, whereas in the North direction the amplitude only shows any seasonal variation. The amplitude is greatest in summer in both directions. The experimental results are compared with those of earlier workers and are discussed in relation to some of the interpretations of the daily variation which have been given. The difference between the variations in the two directions is interpreted as evidence for a nonisotropic distribution of the primary cosmic rays in space. A variation with sidereal and not with solar time would be expected under these conditions, but it is pointed out that the magnetic field of the sun may modify the direction of arrival of the primary rays at the earth so as to produce a resultant solar time variation. (auth)

2691 Evidence for a Charged Heavy Meson. H. H. Forster. Phys. Rev. 77, 733-4(1950) Mar. 1 (Letter to the editor).

The author discusses a photomicrograph of an event recorded in a nuclear emulsion exposed for several hours at 30,000 ft. A charged particle is seen to enter the emulsion from the air and come to rest in the emulsion, producing a nuclear disintegration in which 10 charged particles are ejected. These particles are identified and their energies are calculated with the aid of range-energy relations. For those particles which leave the emulsion, minimum energies are calculated from the path length in the emulsion. From the total energy of all the particles produced in the star, it is estimated that the primary particle has a mass of at least 425 electron masses. If the total energy of the particles not detected in the emulsion is assumed to be of the same order of magnitude as the energy of the particles observed, the mass of the incident particle must be about 700 to 800 electron masses. These mass values yield a lower limit for the lifetime of the particle of about 10^{-12} sec.

2692 Experiments on the Nature of Penetrating Events in Extensive Air Showers. B. Chowdhuri. Proc. Phys. Soc. (London) 63, 165-72(1950) Feb. 1.

The discharges, in coincidence with extensive showers, of individual counters of a group placed in a cavity under 15 cm lead have been studied with particular reference to the number of these counters simultaneously discharged in a single event. It is shown that the observed multiplicity of discharge is not consistent with operation by particles, each discharging one counter only, distributed at random in the extensive shower falling on the apparatus. The multiplicity is also inconsistent with that expected for low energy photons at the extreme range of normal cascades, and with that arising from the secondary electrons of a reasonable μ-meson spectrum. Entry of energy into the shielded cavity is shown to take place over an area much smaller than the total area of the cavity, but the mechanism then leading to the observed multiplicity has not been identified. (auth)

2693 Experiments with a Wilson Chamber at 3860 m Altitude. R. V. Sadovskiĭ, P. A. Cherenkov, I. V. Chuvilo, and L. S. Eĭg. Doklady Akad. Nauk S.S.S.R. 69, 789-92 (1949)(in Russian).

Strongly ionizing particles in cosmic rays at 3860 m altitude were studied with the aid of a Wilson Chamber. If considered as an independent event, the production of a track must obey Poisson's law $N(n) = p^n e^{-p}/n!$, where p and N(n) are the probabilities of the appearance, on one photograph, of, respectively, one and n tracks. Actually, statistics from 14,500 photographs showed higher N(n) values than those calculated with the foregoing formula. From this and the fact that the observed multiple tracks do not originate from one point, it is concluded that the pictures testify to the presence of multiple, genetically correlated, nuclear disintegrations. Further, some of the tracks of strongly ionizing particles (among those obtained in a magnetic field) were accompanied by an abnormally high number of δ electrons. From the maximal ranges of these electrons, the velocity of the particles under consideration could be calculated (by using $T_{max} = 2mc^2\beta^2/(1-\beta^2)$), and the corresponding ionization density estimated. Actually, the ionization density is found to be about 5 times higher than the estimated values. It is concluded that the particles' charge is 4 or 5e, and that the particles themselves are light nuclei (C, B?) produced by fissions. Freier et al (Phys. Rev. 74, 1818(1948)) have observed such particles in the stratosphere.

2694 Fast Protons from the Absorption of π^--Mesons by Nuclei. Stephen Tamor. Phys. Rev. 77, 412-13(1950) Feb. 1 (Letter to the editor).

By the use of a simple model for the production of stars resulting from the absorption of π mesons by nuclei, the author estimates the number of fast protons (energy > 30 Mev) in the stars, and the average excitation energy. It is assumed that the meson is absorbed by a single proton in the nucleus, producing a neutron which moves with high speed through the "gas" of nucleons, while the recoil is absorbed by neighboring nucleons. The fast nucleons may escape without collisions, or may undergo collisions and heat up the nucleus. Two different models were used in the calculations. In the first model the recoil was taken up by only one nucleon, and in the second the recoiling particle was assumed to be the residual part of the α particle of which the absorbing proton was a member. The results are tabulated for N and Ag nuclei.

2695 Generation of Photons by Primary Protons of Cosmic Rays. E. L. Feĭnberg. Zhur. Eksptl. i Teoret. Fiz. 19, 1098-1103(1949)(in Russian).

It is shown that the classical formula for the electromagnetic radiation emitted during the generation (or annihilation) of a charged particle, can be applied, in the quantum region, up to such frequencies ω, for which $\hbar\omega \ll E$, where E is the particle's energy. Consequently, every disappearance of a fast cosmic particle, or a sudden change in its energy, or else an appearance of a newly generated particle, is accompanied by an electromagnetic radiation whose energy is of

the order of magnitude $(e^2/\hbar c)E$. As a special case, this method is applied to the determination of the radiation emitted during a charge-exchange scattering of a fast nucleon. The mechanism described does not seem to furnish an adequate explanation of the genesis of the main part of the cosmic rays' soft component, if the latter is generated by nucleons of $E \cong 10^{10}$ ev. However, since the radiation increases logarithmically with the energy, it follows that for $E > 10^{14}$ ev there must be an emission of several per cent radiation energy during every single act of the fundamental process. A discussion of the known facts concerning extensive atmospheric showers shows that the above considerations may clarify to a considerable extent the problem of the generation of these showers. (auth)

2696 Interpretation of Cosmic-Ray Phenomena. Bruno Rossi. Uspekhi Fiz. Nauk 38, 222-91(1949)(in Russian).

This is a translation of a work published in Revs. Modern Phys. 20, 537(1948). See Nuclear Science Abstracts 1-761.

2697 Mass Measurements on Fast Particles Ejected from Cosmic Ray Stars. J. B. Harding. Nature 165, 273-4 (1950) Feb. 18 (Letter to the editor).

In an investigation of 118 nuclear disintegrations obtained in Kodak NT4 emulsions, exposed to cosmic rays at the jungfraujoch (3,650 m), the identification of particles producing long tracks was attempted. Two methods of mass determination were used: (1) a comparison of the grain density at the beginning and at the end of the tracks, and (2) measurement of the small angle coulomb scattering of the tracks. It was found the 76 particles were produced with velocities between 0.25 and 0.43 c (mean velocity 0.32 c), all of which had on the basis of the two methods of mass analysis presumably the mass of a proton. If they had been π-mesons, ten tracks would have been expected to end in the emulsion. The fact that all these tracks passed out of the surface further confirms the conclusion that at least 90 and probably 100% of particles ejected from nuclei with velocities 0.25 to 0.43 c are protons.

2698 Nuclear Transmutations Produced by Cosmic-Ray Particles of Great Energy. Part III. Nature of the Shower Particles. P. H. Fowler. Phil. Mag. 41, 169-84(1950) Feb.

A new method of measuring the scattering of charged particles in their passage through photographic emulsions has been developed. It has been employed to determine the mass of charged particles emerging from nuclear "explosions" produced by cosmic radiation. Of the mesons among the "shower" particles, produced in these explosions with momentum less than about 180 Mev/c, it is shown that at least 90% are π-particles; and that less than 5%, and possibly none, are μ-particles, electrons or other particles of small mass. If mesons of greater mass are sometimes created in nuclear interactions with an energy less than 300 Mev, they must be produced with a frequency less than 1% of the protons and less than 5% of the π-particles. The observations therefore prove that the great majority of the charged particles created in nuclear interactions are π-particles. The greatly increased rate of measurement with the new method and the fact that it allows the determination of the scattering of particles of much greater energy than

has been possible hitherto will enable a detailed study of the nuclear transmutations produced by protons and α particles with energies in the interval from 10^9 to 10^{10} ev to be made. (auth)

2699 Observations with Electron-Sensitive Plates Exposed to Cosmic Radiation. R. Brown, U. Camerini, P. H. Fowler, H. Muirhead, C. F. Powell, and D. M. Ritson. Uspekhi Fiz. Nauk 38, 526-46(1949)(in Russian).

This is a translation of a work published in Nature 163, 47, 82(1949). See Nuclear Science Abstracts 2-1068 and 2-1195.

2700 On the Absorption Curve of "Primary" Particles of Cosmic Radiation. G. T. Zatsepin. Zhur. Eksptl. i Teoret. Fiz. 19, 1104-7(1949)(in Russian).

Considerable experimental evidence on a cascade-like multiplication of high-energy, disintegration-producing, particles has been accumulated by Russian workers. On the other hand stratospheric determinations of the absorption curve of penetrating particles, which generate showers in lead, have demonstrated the exponential character of that curve; this was interpreted as a proof of an exponential decrease of the number of "primary protons" in the atmosphere with depth, and, consequently, of the disappearance of the primaries in one-act nuclear collisions. However, as the author shows, this last conclusion is binding only in the case of a mono-energetic spectrum. Actually, the energy of the "primary" rays covers a range from 10^9 ev to, at least, 10^{18} ev; therefore, no definite interpretation of the absorption of "primary" cosmic rays is possible. An attempt is made to explain the properties of the absorption curve by a process of charge exchanges between protons and neutrons.

2701 On the Influence of Solar Activity on the Intensity of Cosmic Rays. I. L. Chakraborty and S. D. Chatterjee. Indian J. Phys. 23, 525-34(1949) Dec.

A report of a sudden increase in cosmic ray intensity following the solar flare on January 25, 1949, is given. It is accompanied by a rapid diminuation in cosmic ray intensity and a slow recovery as a result of the concomitant magnetic storm. The relationship of the two processes with solar activity is discussed. (auth)

2702 On the μ Meson Capture. Mituo Taketani, Muneo Sasaki, and Seitaro Nakamura. Progress Theoret Phys. 4, 552-6(1949) Oct.-Dec.

This is an amplified version of a letter to the editor, which appeared in the Physical Review (76, 852(1949)) and was abstracted in Nuclear Science Abstracts as No. 3-1691.

2703 On the Nature of the Cosmic Radiation Near the Pfotzer Maximum at $\lambda = 41°$N. S. F. Singer. Phys. Rev. 77, 730(1950) Mar. 1 (Letter to the editor).

A direct measurement of the primary specific ionization of the cosmic radiation above the atmosphere by means of a "low efficiency telescope" in a V-2 rocket launched at White Sands, New Mexico ($\lambda = 41°$N) has been previously reported (Phys. Rev. 76, 701(1949)). The measurement was carried out essentially by comparing the efficiency of a low pressure hydrogen-filled G-M counter near sea level and above the atmosphere. In the present note the author reports on the data obtained by the telescope in its passage through the atmosphere. The primary specific ionization of the radiation

PHYSICS

appeared to pass through a maximum near the position of the Pfotzer maximum of the total cosmic-ray flux. It is concluded that the bulk of the cosmic-ray flux at high altitudes does not consist of low energy electrons, but may consist of slow protons and mesons. Other authors have reported similar results (Pomerantz, Phys. Rev. 75, 69(1949)).

2704 On the Nuclear Stars. Yoichi Fujimoto and Yoshio Yamaguchi. Progress Theoret. Phys. 4, 468-76(1949) Oct.-Dec.

This paper is an amplified version of a letter to the editor, On the Cosmic-Ray Stars, which appeared in Phys. Rev. 75, 1776(1949). An abstract was listed in Nuclear Science Abstracts as No. 3-725.

2705 Processes Involving Vector Mesons. James N. Snyder. Phys. Rev. 77, 143(1950) Jan. 1 (Letter to the editor).

A particle subject to spontaneous decay could conceivably have its decay constant altered by interaction with other particles. This stimulated decay, for the case of a scalar particle subject to two-particle decay and interacting with a nucleon, has already been treated (Furry and Snyder, Phys. Rev. 75, 1265(1949)), and the effect has been found to be very small. But if the particle under consideration is a vector meson, the effects of the stimulation should be much more important. Rough calculations show that, if the π meson is a vector particle, its lifetime should be cut in half when traversing solid matter with an energy of 10^5 mc^2. This shortening is expected to be more important during the production of mesons by collisions of primary protons with atmospheric nucleons. It is emphasized that the calculations are very crude since the effects of radiation damping and multiple meson production are neglected.

2706 Some Properties of Penetrating Cosmic-Ray Showers and Star Phenomena Seen in the Cloud Chamber. C. C. Butler, W. G. V. Rosser, and K. H. Barker. Proc. Phys. Soc. (London) 63, 145-64(1950) Feb. 1.

Cloud-chamber photographs of cosmic-ray showers containing penetrating particles have been obtained at sea level. The spectrum of the penetrating particles has been measured and a study made of the interaction of the energetic particles in lead and in the gas of the cloud chamber. Conclusions about the nature of the penetrating particles are discussed; these show that about half the penetrating particles are protons and the remainder are probably π mesons and mesons of heavier mass. Three heavy particles produced in stars are probably τ mesons. (auth)

2707 An Inexpensive Automatic Dial Gage Strain Recorder. C. D. Nail and E. R. Parker. COO-8, Jan. 1950. 13p.

A simple automatic recorder, costing only $65.00 to build, has been developed for measuring continuous elongations over long periods of time. This equipment uses a modified dial gage as the measuring device and a synchronous motor driven chart to provide a time base. The standard dial gage face is replaced by one which permits making and breaking an electrical contact each time the pointer passes a division on the gage. The electrical impulse is transmitted to a gaseous relay tube circuit which actuates a relay attached to a chart pen. Each time the dial contact is made a mark appears on the recording chart. (auth)

PHYSICS

2708 History of Deflected-Electron-Beam Devices. Jacob Wiren. Northwestern University, Mar. 31, 1949. 94p. (AEC File No. NP-1180.)

This report summarizes a survey of literature pertaining to the development and application of electron-beam devices in which a deflected stream of electrons is used to produce the desired output characteristics. These have been classified and discussed under the following 5 general headings: (1) Amplifiers, (2) Modulators and Converters, (3) Waveform and Function Generators, (4) Electronic Switches, and (5) Control Systems and Related Devices. Applications of electron-beam deflection to display purposes and electron-optical uses have not been included in this survey. 74 references. (auth)

2709 A Magnetic Field Stabilization Circuit. L. Katz, P. A. Forsyth, L. F. Cudney, G. W. Williams, H. E. Johns, and R. N. H. Haslam. Can.J. Research 28A, 67-72(1950) Jan.

The paper describes the apparatus used to stabilize the magnetic field of a large electromagnet. A rotating coil placed in the magnetic field generates an alternating voltage which is proportional to the strength of the field. Variations in this rotor voltage are used to control the current supplied to the electromagnet in such a manner as to keep the field constant. By means of a calibrated field control the magnetic field strength may be adjusted to any value between 500 to 6,000 gauss. The current for the electromagnet is obtained by rectifying 60-cycle alternating current in a full wave, thyratron, rectifier circuit. This current is controlled by a pulse circuit which governs the fraction of each cycle during which the thyratrons are conducting. The stabilization at any field setting is better than 1 part in 1,000. (auth)

2710 Output Characteristics of a Commercial X-ray Generator at 2000 kvp. F. W. Chambers, Jr., J. E. Morgan, and J. T. Istock. Naval Medical Research Institute, Dec. 7, 1949. 23p. (AEC File No. NP-1411.)

A quantitative survey of x-ray emission patterns from a commercial 2000 kvp generator is presented, with particular attention toward applicability in medical research. Characteristics of the transmitted beam and of the radial beam are evaluated.

2711 Safety Arrangement for X-ray Apparatus. Marvin F. Hall. U. S. Patent 2,492,281, Dec. 27, 1949.

An arrangement of electrical circuits is described which controls the current supply to the high voltage circuits of an x-ray tube. These controls can be pre-set in such a way that accidental overdosage in x-ray therapy is prevented.

2712 A Simple Battery Operated Pirani Gauge Power Pack. A. H. Turnbull. Atomic Energy Research Establishment Report No. AERE-G/R-462, Jan. 1950. 8p.

A simple battery operated power pack for use with Metropolitan-Vickers type of Pirani gauge is described. The lowest measurable pressure is about 10^{-3} mm Hg. Provision is made for flashing the gauge filament and for replacing the internal meter by a galvanometer for leak hunting. The "zero voltage", i.e., the voltage which must be applied to the bridge to balance it when the gauge is at zero pressure, varies from one M-V Pirani gauge to another. A single calibration curve can be applied to all gauges of this type (with a maximum error of $\pm$ 6% over the pressure range 0-150 μHg) provided that the

PHYSICS

correct "zero voltage" is applied to the bridge for each individual gauge. (auth)

2713 Wide-Range, Tunable, Low-Power Magnetrons Above 2000 Megacycles; Interim Progress Report for the Period March 27, 1949, to May 27, 1949. L. R. Bloom University of Illinois, June 27, 1949. 9p. (AEC File No. NP-1214.)

Work has continued on the development of the two types of tunable magnetrons designated as MS4-B and MS5-C. A total of 7 tubes of both types were completed during this period. Of these 5 were hot tested. The MS4-B magnetron is Construct ed so that all alternate vanes are connected either to the inner or outer conductor of a coaxial resonator. Tuning is accomplished by adjusting the shorting plunger in the coaxial resonator. The MS5-C magnetron is a short-anode magnetron tuned by means of ganged inductive and capacitative ring tuners.

2714 X-ray Tube. Jacob Harmannus van der Tuuk and Johannes Jan Smit (to N. V. Philips' Gloeilampenfabrieken, Eindhoven, Holland). Canadian Patent 463,587, March 7, 1950.

This invention describes an x-ray tube consisting of a cathode-electrode, a rotatable anode-electrode and a screen comprising a cylindrical portion surrounding the anode and a disc-shaped portion enclosing the cylindrical portion and placed between the anode and the cathode; the cylindrical portion is mounted on a support member which also supports the anode so that the anode is completely enclosed by the screen. The disc-shaped portion of the screen has an aperture for the emission of the electrons and the cylindrical portion has an aperture for the passage of the x-rays. The inner side of the screen has a surface capable of absorbing heat while the outer surface of the anode radiates heat; the outer surface of the screen is made smooth in order to prevent secondary emission and the screen has apertures opposite the poles of the magnet system surrounding the tube, for the passage of the magnet flux.

2715 A Redetermination of the Relative Abundances of the Isotopes of Carbon, Nitrogen, Oxygen, Argon, and Potassium. Alfred O. Nier. Phys. Rev. 77, 789-93 (1950) Mar. 15.

Essentially pure samples of A^{36} and A^{40} have been produced by thermal diffusion and used for the preparation of synthetic argon isotope mixtures whose A^{36}/A^{40} isotope abundance ratios were very accurately determined. The mixtures were then employed for determining the mass discriminating effects in two mass spectrometers. Carbon, nitrogen, oxygen, argon, and potassium were investigated and new values were given for the relative abundances of the isotopes. With atmospheric oxygen as a standard, the conversion factor between the physical and chemical atomic weight scales is 1.0002783 ± 5. The percentage abundance of K^{40} in potassium is found to be $0.0119 \pm 0.0001\%$, a figure of special interest in geophysical problems, and approximately 10% higher than the present accepted value. (auth)

2716 Apparatus for Isotope Separation by Thermal Diffusion. W. W. Watson, L. Onsager, and A. Zucker. Rev. Sci. Instruments 20, 924-7(1949) Dec.

PHYSICS

A compact, all-metal, multistage thermal diffusion apparatus for the separation of isotopes in quantity in noncorrosive gases at any pressure up to 175 psi is described. The optimum pressure for the separation of the isotopes of a particular gas may be approximated, with sufficient accuracy, by the optimum pressure as calculated for the last stage of the diffusion apparatus. (auth)

2717 An Electromagnetic Isotope Separator. Ingmar Bergström, Sigvard Thulin, Nils Svartholm, and Kai Siegbahn. Arkiv Fysik 1, 281-92(1949).

An isotope separator is described which was designed to separate isotopes of all the elements within reasonable time and in amounts up to several mg. After a discussion of the general requirements of such a separator, specific details of construction are given for the ion source, the lens system, the magnet and its accessory equipment, the collector device, the vacuum system and the control system. Using this separator, the authors were able to determine that of the isotopes Hg^{205} and Hg^{203} the latter is responsible for a β-activity with a half life of 53 days, which confirms the suggestion of M. G. Inghram, D. C. Hess Jr., and R. J. Hayden (Phys. Rev. 71, 561(1947)), and similarly that the 225-day activity of silver belongs to Ag^{110} and the 13 hr activity of palladium to Pd^{109}.

2718 Isotopic Exchange Reactions of Gaseous Ethyl Bromide with Bromine, Hydrogen Bromide, and Deuterium Bromide. John B. Peri and Farrington Daniels. J. Am. Chem. Soc. 72, 424-32(1950) Jan.

Bromine reacts with ethyl bromide below 350° to give the dibromide. Direct exchange of radioactive bromine into ethyl bromide occurs only through reaction with the products of the reaction. The bromine of hydrogen bromide exchanges with ethyl bromide from 180−310° with an activation energy of 31.5 ± 1.0 kcal/mole. The reaction is first order with respect to ethyl bromide and zero order with respect to HBr*. The rate depends on the surface area and nature of the wall. The deuterium of deuterium bromide exchanges with all five hydrogens of ethyl bromide between 258 and 306° with an activation energy of 40 ± 4 kcal/mole. The reaction is roughly first order with respect to ethyl bromide and first order with respect to deuterium bromide. The exchange of bromine and deuterium were studied simultaneously, also, using deuterium bromide containing radioactive bromine. A mechanism for the exchange reactions is proposed which involves free radicals produced on the walls. It is believed that the bromine exchange is a wall reaction and that deuterium exchange is a chain starting and ending on the wall. The mechanisms proposed for exchange are applicable also to the thermal decomposition of ethyl bromide at higher temperatures. (auth)

2719 On Exchange Reactions Following Nuclear Transformations of the Type (n,γ). A. S. Karamyan. Doklady Akad. Nauk S.S.S.R. 69, 787-8(1949)(in Russian).

It is known that no quantitative yields can be obtained in the isolation of isotopes by the Szilard-Chalmers method. The author has shown (Doklady Akad. Nauk S.S.S.R. 68, No. 2(1949)) that in the case of C_2H_5Br all radioactive Br atoms are originally expelled from the molecules, and that some of them are subsequently re-caught ("subsequent synthesis").

PHYSICS

In the present work this process was given a comparative study using CH_3Br, C_2H_5Br, C_3H_7Br, C_4H_9Br, $C_5H_{11}Br$, and $C_9H_{13}Br$. After irradiation of equal volumes of these substances with slow neutrons, free atoms of radioactive Br were electrically deposited on Ag; the samples were compared according to Br^{80*} and Br^{82} activities. The results showed that the effect of the "subsequent synthesis" is stronger in compounds with odd numbers of C atoms than in the even series, and that in either series the effect increases with the length of the molecule.

2720 Some Recent Work on the Separation and Use of Stable Isotopes. I. Lauder. J. Proc. Roy. Soc. N. S. Wales 82, 183-95(1949) Oct. 18.

The author discusses the following methods which have been used for the separation of stable isotopes: diffusion, distillation, chemical exchange, thermal diffusion, and the centrifugal method. This latter method has not been very successful in the past but may be used more often in the future. No reference is made to separation methods developed in wartime research. The discussion of biological applications is limited to a description of the use of deuterium in the study of fat metabolism in rats and mice. The remainder of the paper is devoted to an outline of the use of heavy oxygen, heavy nitrogen, and heavy carbon in the investigation of chemical processes, and the applications of these isotopes to analytical problems.

2721 A Convenient Gas Sample Tube Holder and Break-Off Applicable to Mass Spectrometers. Frederick Highhouse and Julius White. Rev. Sci. Instruments 21, 101-2(1950) Jan. (Laboratory and shop note).

It is often necessary to store gas samples in sealed glass ampules for some time before mass spectrometer analysis. The authors have devised a gas sample tube holder and a break-off which may be used directly on the spectrometer to facilitate the transfer of the gas from the ampule to the mass spectrometer. This device is described in detail.

2722 Determination of Isotope Ratios of Known Deuterium-Hydrogen Samples Using a Mass Spectrometer. Roslyn B. Alfin-Slater, S. M. Rock, and Marie Swislocki. Anal. Chem. 22, 421-3(1950) Mar.

A satisfactory procedure for determination of deuterium-hydrogen mixtures has been developed using the Consolidated-Nier 21-201 mass spectrometer. The minimum detectable difference from normal distilled water when frequent standards are run is 0.0004 at. %, or less under favorable conditions. Over the entire range, reproducibility is ±1% of the ratio for periods of several hours and ±3% of the ratio for longer periods. It was found that instrumental factors, including the setting of the source magnet, affect materially the value of the ratio of HD/H_2 obtained. Hence, the instrument was calibrated with synthetic samples of known deuterium enrichments, hydrogen obtained from doubly distilled water being used as zero enrichment. In preparing the calibrating samples, it was found necessary to collect hydrogen from the entire water sample placed in the reduction apparatus, as a different ratio was obtained from the first and last half of the reduction. The calibration curve showing known enrichment plotted against measured

PHYSICS

HD/HH ratio can be used for a range of operating conditions and hence for an extended period of time and has the advantage of yielding results in nearly absolute enrichment. (auth)

2723 The Mass of He^4. Von Heinz Ewald. Z. Naturforsch 5a, 1-5(1950)Jan. (in German).

In measuring the mass difference in the D_2-He doublet with a mass spectrometer, the lines were positioned at various regions on the photographic plate by means of a variable magnetic field. A variation in the results was found to be caused by slight inhomogeneities in the field. The author shows how this variation was corrected for by the use of other groups as standards. The difference in the D_2-He doublet was determined as $25.604 \pm 0.008 \times 10^{-3}$ mass units.

2724 Mass Spectra of N_2^{14}, $N^{14}N^{15}$ and N_2^{15}. Vernon H. Dibeler, Fred L. Mohler, and Robert M. Reese. J. Chem. Phys. 18, 156(1950) Jan. (Letter to the editor).

A sample of nitrogen gas containing approximately 65 at. % N^{15} was analyzed in a mass spectrometer. The mass spectrum of this material permits an accurate calculation of the relative amounts of doubly charged N_2 ions and a calculation of the dissociation patterns of the three isotopic nitrogen molecules. This data was obtained and is tabulated in the letter. A significant difference is noted in the dissociation probability of N_2^{14} and N_2^{15}.

2725 Mass Spectrometry. Martin Shepherd and John A. Hipple. Anal. Chem. 22, 23-25(1950) Jan.

A review is presented of mass spectrometry, dealing especially with analytical applications, applications to chemistry and physics, mass spectra, and instrumentation. An extensive bibliography (79 items) is appended, covering the literature of 1948 and 1949.

2726 Negative Ions of Rubidium and Cesium. V. M. Dukel'skiĭ, E. Ya. Zandberg, and N. I. Ionov. Doklady Akad. Nauk S.S.S.R. 68, 31-2(1949)(in Russian).

In a former paper (Doklady Akad. Nauk 62, 323(1948)), the authors related on the presence of negative ions of Li, Na, and K among the products of the electric discharge in vapors of halogen salts of these metals. In the present note, similar experiments with RbCl and CsCl are described, resulting in the discovery of negative ions $(Rb^{85})^-$, $(Rb^{87})^-$ and $(Cs^{133})^-$. Ions produced by an incandescent-cathode discharge were pumped into a vacuum, accelerated to 1,350 ev and analyzed in a mass spectrometer. All alkaline metals are thus found to possess an affinity toward an additional electron, with the formation of stable negative ions. This can be explained by the readiness to complete the outer s shell, a process accompanied by a diminuation of energy.

2727 A New Type Mass Spectrometer. Larkin Kerwin. Rev. Sci. Instruments 21, 96-7(1950) Jan. (Laboratory and shop note).

The author describes the design and operation of a recently designed and tested mass spectrometer utilizing an inflection lens. Although the mechanical appearance of the analyzing field is about the same as for conventional spec-

PHYSICS

trometers, the use of the new focusing principle (Hintenberger, Rev. Sci. Instruments 20, 748(1949); Kerwin, 20, 36(1949)) has resulted in third-order focusing. A typical spectrogram is reproduced, showing an iodine peak in the presence of naphthalene. The resolving power is calculated and the operation of this type of spectrometer is compared with the operation of the conventional type. Possible future improvements are discussed.

2728 Radiofrequency Mass Spectrometer. Willard H. Bennett. J. Applied Phys. 21, 143-9(1950) Feb.

A mass spectrometer tube using velocity selection is described. The tube has parallel plane grids made with knitted wire nets with a large percentage of open area. The grids are arranged in groups of three, and radiofrequency alternating potential is applied to the middle grid of each group. Stopping potentials are used to turn back all ions except those with the selected mass. The spectrometer has sufficient resolution for ordinary gas analysis requirements and is simpler, more rugged than magnetic beam deflection devices. (auth)

2729 Statistical Applications of the Sample Range. Osmer S. Carpenter. K-492, Aug. 30, 1949. 17p.

The purpose of this report is to explain the use of "sample range" (the difference between the largest and smallest values in a sample). Because of its simplicity of computation, the sample range provides a useful statistic for many applications. The applications discussed are: (1) point estimation of the population standard deviation; (2) confidence interval estimation of the population standard deviation; (3) establishing probability levels for sample range; (4) use in tests analogous to Student's t-test. The advantages and limitations of the range statistic are discussed. The information given here provides methods for converting results given in terms of range into other measures of variability. It is emphasized that these methods are based on the assumption of random sampling from an infinite normal population; the extent to which they are applicable to nonnormal populations has not been investigated.

2730 A Portable Alpha Survey Meter. W. M. Hurst, G. S. Hurst, and W. B. McDonald. ORNL-602, Mar. 14, 1950. 23p.

This article describes a portable alpha survey meter having a specific application to Health Physics survey work where the objective is detection and semi-quantitative measurement of α particles. The total weight of the instrument is 4 pounds, and it includes a proportional counter, amplifier with thyratron output tube, headphones for aural counting, and batteries to supply all the required voltages. The background count is approximately 1 cpm, and an α source of 100 disintegrations per minute in an area appreciably less than the proportional counter window can be detected with approximately 15 cpm in the headphones. Lower values of contamination are detected proportionately. The proportional counter includes a desiccant whereby the instrument can be used in an ambient of 95% relative humidity. 13 references. (auth)

2731 The Behavior of Rectangular and Square Section Transparent Beta-Counters. L. M. Silver and J. B. Warren. Rev. Sci. Instruments 21, 95-6(1950) Jan. (Laboratory and shop note).

PHYSICS

For some experiments it is necessary to use a Geiger counter through which β rays of moderatley low energies may pass. Counters have been constructed, using rectangular section (1 in. × ½ in.) and square section (⅞ in. × ⅞ in.) brass tubing envelopes in the sides of which apertures up to 1 in. × ½ in. have been milled and covered with mica windows. In this way with 2 mg/cm² windows the stopping power of the counter may be kept to 4 mg/cm² as compared to the 60 mg/cm² needed for a conventional cylindrical thin-walled glass counter with 30 mg/cm² wall thickness. The previously reported advantages of such counters (Curran and Reid, Rev. Sci. Instruments 19, 67(1948)), such as short dead time, have been substantiated, but it was found necessary to make the inside of the mica conducting to prevent the interruption of the discharge at the mica surface. The failure of the discharge to spread is due to the small misalignment of the window with the inside surface of the envelope.

2732 Conductivity Pulses Induced in Insulating Liquids by Ionizing Radiations. Norman Davidson and A. E. Larsh, Jr. Phys. Rev. 77, 706-11(1950) Mar. 1. (See also NSA 1-661.)

Conductivity pulses due to electron collection have been observed in liquid and solid argon exposed to α or γ radiation. The maximum pulse sizes, P_M, for α particles depend only on the field strength, E, and not on the electrode spacing, proving that the pulse limiting effect is columnar recombination and not electron trapping by impurities. The maximum pulse sizes obey the equation $(P_M/P_O) = 1-\exp(-AE^{1/2})$, where P_O is the α-pulse size in an argon gas counter. The counting efficiency for α particles is close to 100%, but there is some variation in pulse size due to variation of columnar recombination with angle of emission. No α or γ pulses were observed in liquid nitrogen or heptane, but weak α-induced pulses were observed in liquid methane. The effects of nitrogen and oxygen in solution in liquid argon in decreasing the pulse sizes are interpreted as being due to electron capture by these molecules. (auth)

2733 Crystal Counters. R. Hofstadter. Uspekhi Fiz. Nauk 39, 426-555(1949)(in Russian).

This is a translation of a paper published in Nucleonics 4, 2(1949). See Nuclear Science Abstracts 2-2007.

2734 Determination of Very Small Amounts of Radioactive Substances by the Photographic Method of Counting Tracks. E. Broda. Monatshefte Chemie 80, 765-70(1949)(in German).

The counting of the tracks of α particles in photographic emulsions is described. The substance to be examined is embedded in the emulsion by soaking the plate in an appropriate solution. The counting of tracks will serve either to determine half-lives, if the concentration of the substance in the emulsion is known, or to detect analytically substances of known half-life. The accuracy of the photographic method exceeds that of counting by means of a Geiger-Mueller counter, and is suitable for the detection of a large number of elements, among them Sm, Pb, Bi, Ra, Th, and U. (auth)

2735 An Extremely Stable Power Supply for Scintillation Counter Use. Joe Keagy Bair and E. E. St. John. NEPA-1265, Jan. 20, 1950. 9p.

PHYSICS

A simple high voltage supply using 5651-type voltage reference tubes has been designed, constructed, and tested. This supply appears to have voltage stability which is orders of magnitude better than those normally used. The circuit has no critical components or adjustments. Construction details and test results are described. (auth)

2736 Fluctuations of the Ionization Effect. M. I. Podgoretskiĭ. Doklady Akad. Nauk S.S.S.R. 67, 823-6(1949)(in Russian).

In a previous note (Doklady Akad. Nauk S.S.S.R. 67, 631(1949)) the author has pointed out the differences between the mechanism determining the value of the ionization effect and the mechanism of the energy losses. As a consequence, in counters of small cross-sectional areas and with not too thick walls, the average ionization effect is smaller than the average energy losses. In counters whose cross section is sufficiently large, (or the walls are sufficiently thick), the average ionization effect is equal to the average energy losses; it is shown, however, that the probability curve of the distribution of the ionization effect differs from the distribution curve of the energy losses, (on this latter curve see Landau, J. Physics U.S.S.R. 8, 204(1944)). This circumstance should be taken into consideration when calibrating proportional counters. Another problem of interest is that of the calculation of the dispersion of the ionization effect, this quantity being often met with in computations involving fluctuations.

2737 An Improved Neon-Lamp Radium Detector. R. G. Gosling. Brit. J. Radiol. 23, 198-201(1950) Mar.

The author discusses the use of neon tubes for γ-ray counting and describes in detail an apparatus for use with a commercial tube working at about 170 v, and with a plateau at 15 v. Some data on experiments testing the performance of this counter are given and an adaptation for use as a dose-rate meter is suggested.

2738 Measurements of the Energy of Beta- and Gamma-rays with a Scintillation Counter. Sven A. E. Johansson. Nature 165, 396(1950) March 11 (Letter to the editor).

Gamma-rays incident on the phosphor of a scintillation counter produce photoelectrons which, in turn, give rise to pulses in the counter. If the counter is bombarded by a beam of gamma rays of various energies, a plot of counting rate against pulse height will exhibit peaks at pulse heights corresponding to the energies of the photoelectrons produced by the various gammas. If the counter has been calibrated by measuring the pulse heights produced by photoelectrons of various energies, the positions of the peaks may be used to determine the gamma-ray energies. The counter may then also be used to measure the energies of incident electrons, with good precision.

2739 A New Type of Nuclear Research Emulsion. H. E. Huntley. S. African J. Sci. 46, 24-5(1949) Aug.

Heretofore particles of small ionizing power could not be recorded by the emulsion technique. The research department of Kodak, Ltd., and Ilford, Ltd., have produced within the last few months a new photographic emulsion capable of recording the tracks of any ionizing particles of any energy. So far this new emulsion has been used chiefly in the field of cosmic ray research. Microphotographs of a π-meson decay track and cosmic-ray meson showers illustrate the potentialities of the new technique.

2740 Photographic Plates for use in Nuclear Physics. J. H. Webb. Uspekhi Fiz. Nauk 38, 77-113(1949) (in Russian).

This is a translation of a paper published in Phys. Rev. 74, 511(1948). See Nuclear Science Abstracts 1-1152.

2741 A Portable Geiger Counter. M. Michaelis and R. O. Jenkins. Electronic Eng. 22, 112-15(1950) Mar.

Circuit and construction details are given for a portable Geiger counter $9 \times 6 \times 3\frac{1}{2}$ in. and weighing 7 lb. This instrument may be operated from small, self-contained batteries, or may be connected to larger batteries if they are available. The G M tube may be used with either β, γ or x-rays. The counting is indicated by a microammeter, which may be calibrated with the aid of a calibration curve given by the authors.

2742 Principle of a Double-Lens Spectrometer for Beta and Gamma Rays. W. Bothe. Naturwissenschaften 37, 41(1950)(Brief report, in German).

Magnetic lens spectrometers must be constructed so as to avoid spherical aberration, which diminishes either the intensity or the resolving power. Thin lenses have necessarily a strong spherical aberration. Thick lenses on the other hand reduce spherical aberration, but are expensive and difficult to operate. It is shown here how by the combination of two thin lenses the resolving power can be increased by an order of magnitude compared to that obtained with one lens only, without any loss of intensity.

2743 The Quantitative Determination of Gamma Radiation in Biological Research. R. F. Hill, G. J. Hine, and L. D. Marinelli. Am. J. Roentgenol. and Radium Therapy 63, 160-9(1950) Feb.

Plots are given for the sensitivity of lead, aluminum, and brass-walled counters as a function of the γ ray energy. These sensitivities are fairly low and may be improved by a multicellular tube design, a design equivalent to several counters in parallel. Several types of multicellular counter tubes are described. The authors then discuss the use of counter tubes for measurements on liquid and dried samples. With liquid samples, very good geometry may be obtained by surrounding the counter with the liquid, or by inserting the liquid, in a beaker, into a specially designed counter. The advantages of scintillation counters are discussed. The remainder of the article is devoted to the techniques involved in in vivo measurements. An apparatus which may be used for quantitative measurements on thyroid glands is described, and the geometry problem in such measurements is analyzed.

2744 Quantum Efficiency in Photographic X-ray Exposures. D. Bromley and R. H. Herz. Proc. Phys. Soc. (London) 63B, 90-106(1950) Feb. 1.

The grain yield per absorbed quantum has been evaluated experimentally for four different photographic emulsions over a wavelength range of 1.2 to 0.01 A, i.e., from very soft x-rays to γ rays emitted from radium. The tests were carried out with both heterogeneous and monochromatic

x-rays. A grain yield of 1.0 per absorbed quantum appears to hold within a range of wavelengths of 1.2 to 0.37 A (10 to 33 kv). From 0.37 A to short wavelengths (γ rays) an increase of grain yield linear with quantum energy is obtained. At a wavelength of 0.0123 A (1,000 kv) about 80 grains are rendered developable per quantum absorbed. The rate of increase of grain yield with quantum energy is different for different emulsions. For a slow and fine-grain chloro-bromide emulsion the grain yield was found to be less than unity for wavelengths below 0.12 A (i.e., 100 kv). The results are consistent with the hypothesis that grains are made developable not only by the direct action of x-rays but also by secondary electrons produced by the x-rays. These are effective only when they are energetic enough to reach grains in the neighborhood of that absorbing the original x-ray quantum. (auth)

2745 A Radioactivity 'Scanning' Device for Paper Chromatograms Using Phosphorus-32. J. C. Boursnell. Nature 165, 399(1950) March 11 (Letter to the editor).

An apparatus has been developed for measuring quantitatively, by counting, the distribution of radioactivity on filter paper chromatograms. The specific purpose in view has been to measure the amounts of radioactive phosphorus present in various phosphate esters as separated on filter paper chromatograms by the methods described recently by Hanes and Isherwood (Nature 164, 1107(1949)). The apparatus consists of a flat ¼ in. brass plate, into which is let a thinner plate of 1 mm brass in which a 1 cm square hole has been cut. The size of the apparatus and the position of the hole are such that any portion of a 23 cm wide paper of any length may be scanned. A G-M counter with an end window is mounted behind the square hole. Construction details are given. Tests with this apparatus have shown that spots with known quantities of radioactive phosphate, but of different areas, can be scanned to an accuracy of about 1%.

2746 Range-Energy Relation for Protons and Alpha-Particles in Photographic Emulsions for Nuclear Research. J. Rotblat. Nature 165, 387-8(1950) March 11.

The author has studied the stopping power of various nuclear emulsions by exposing them to protons and α-particles scattered through different angles by a beam by of 8-Mev deuterons from the Liverpool cyclotron. For this purpose the beam was made to pass through a chamber filled with hydrogen or helium at pressures of 15 or 10 cm respectively. In order to determine the energy of the beam, the plates were also exposed to α-particles from polonium and thorium, and several points on the stopping power curve for α-particles were thus determined. The scattering angle for α-particles having the same range as the alphas from one of the radioactive sources was then measured, and the beam energy could be calculated from this scattering angle. Using this beam energy, the energies of the scattered particles could be calculated from the scattering angles. Range-energy plots are given for protons and α-particles in C.2 emulsions. At higher energies, these results differ very little from those of Lattes, Fowler, and Cuer (Nature 159, 301(1947)) but significant differences appear at low energies. Other types of emulsions have very similar stopping power curves. Straggling of protons and α-particles was also investigated, and the half-widths of the range-energy distribution for various energies is tabulated.

2747 Small Probing Geiger-Mueller Counters. C. V. Robinson. Rev. Sci. Instruments 21, 82-4(1950) Jan.

Experiments with argon-ethyl acetate mixture in small counters are described and threshold voltages, plateau lengths and plateau slopes are tabulated for various ethyl acetate and argon pressures. These counters give a much longer plateau than the small ether argon counters previously designed (C. V. Robinson and R. E. Peterson, Rev. Sci. Instruments 19, 911(1948)). The ethyl acetate-argon counters are not permanently damaged by excessive voltages, while the ether-argon counters do not recover from breakdown. Details of construction are given for two designs of brain-probing counters of 3- and 2-mm diameters. To obtain as much life as possible a cathode follower, preamplifier or quench circuit is used with these counters, and the operating voltage is kept near threshold.

2748 Trajectories of Ionizing Particles in Photographic Emulsions. Luc Gilion. Rev. questions sci. 11, 53-69(1950) Jan. 20 (in French).

The author outlines the historical development of the various methods of particle detection, describing the operation of the Wilson cloud chamber, and briefly mentioning other types of detectors, such as the Geiger counter and the ionization chamber. However, the article is principally concerned with the use of photographic plates in studying particle trajectories. After a description of the action of photographic plates in general, and of nuclear plates in particular, the author discusses the methods used and the results obtained with photographic plates in the study of mesons, both in cosmic rays and in conjunction with the cyclotron. The article concludes with a discussion of other applications of the photographic plates, such as the use of loaded plates in cyclotron experiments.

2749 Wilson Cloud Chamber. F. E. Christensen. Am. J. Phys. 18, 149-50(1950) March.

The Wilson cloud chamber described in this article is designed primarily as a demonstration device in general physics. The chamber is of simple construction, operating at a pressure of approximately 10 cm of mercury above one atmosphere. It is first filled with helium, and a solution of water and pure ethyl alcohol is subsequently added. This cloud chamber is usually used with a polonium source. The author gives a schematic diagram of construction details.

2750 Research on Turbulence and Diffusion of Particulate Matter in the Lower Layers of the Atmosphere; August 1, 1949 - October 31, 1949. E. Wendell Hewson. M. I. T. Round Hill Field Station Progress Report No. 4, Nov. 10, 1949. 46p. (AEC File No. NP-1409.)

The tower installation has been checked in the following respects: wind speed transmitters have been calibrated; wind direction transmitters have been checked for accuracy; temperature measuring units have been calibrated. The radiation shielding for the latter is described in detail. A timer for the simultaneous operation of the moving picture

cameras has been constructed, used, and found satisfactory. Plans have been laid and equipment obtained for a portable tower for measuring vertical gradients of wind and temperature at various locations. For studies of diurnal variations of turbulence and their effect on diffusion of particulate matter from elevated sources, a flow meter for the smoke generator has been obtained and installed, and kite balloons for carrying aloft a smoke densitometer have been purchased. The technique of studying turbulent motion of particulate matter has been developed and has been tested by studying the motion of small zero lift balloons. The velocities and accelerations of the latter have been measured. With further refinements the method will be used with color film to study the turbulent motion of soap bubbles. The physical aspects of eddy motion have been investigated with the aid of motion pictures of smoke from a point source. The vertical and along-wind dimensions of upward moving puffs from the main smoke stream and of the gaps between them have been measured and frequency distributions of size determined. Preliminary measurements of surface albedos have also been made. The development of instrumentation for the determination of eddy coefficients is proceeding: tests made with a very sensitive strain gauge suggests that such an instrument will be satisfactory for use as the basic element in the apparatus for measuring vertical eddy velocity components; the fluctuating temperature anomaly will be determined by an especially developed thermocouple. The use of springs to obtain a linear velocity response is under consideration. (auth)

2751 Microwave Spectra and Molecular Constants of Trifluorosilane Derivatives — SiF_3H, SiF_3CH_3, SiF_3Cl, and SiF_3Br. John Sheridan and Walter Gordy. Phys. Rev. 77, 719(1950) Mar. 1 (Letter to the editor).

Results are presented of a microwave-spectroscopic examination of the trifluorosilane derivatives, SiF_3H, SiF_3CH_3, SiF_3Cl, and SiF_3Br, including the rotational frequencies for various transitions, and the distances between the atoms in these crystals.

2752 The Microwave Spectrum and Molecular Structure of Cyanoacetylene. A. A. Westenberg and E. Bright Wilson, Jr. J. Am. Chem. Soc. 72, 199-200(1950) Jan.

The pure rotation spectra of ten isotopic species of the linear molecules $H-C\equiv C-C\equiv N$ and $D-C\equiv C-C\equiv N$ have been observed and analyzed in the microwave region. The data obtained on the rigid rotor basis are: (1) Bond distances: $H-C = 1.057 \pm 0.001$ A, $C\equiv C = 1.203$, $C-C = 1.382$, $C\equiv N = 1.157$. (2) Nuclear quadrupole coupling constant for N^{14}: $eqQ = -4.2$ mc. (3) Dipole moment: $\mu = 3.6 \pm 0.2$ D. (auth)

2753 Structural Investigations of Nuclear Magnetism. II. Hindered Rotation in Solids. H. S. Gutowsky and G. E. Pake. J. Chem. Phys. 18, 162-70(1950) Feb. (See also NSA 2-780.)

The experimental absorption line widths, for nuclei with spin ½, at nuclear magnetic resonance are given as a function of temperature for a number of molecular crystals. Temperatures ranged from 90°K to the melting points of the compounds. In some cases it has been possible to relate observed line structure in transitions in line width to the existence and frequency of certain types of hindered rotational motion in the solid state. These deductions are based on mathematical considerations of the quantitative effect of such motions on the structure and second moment of an absorption line. It is emphasized that relatively low frequency of motion of the order 10^5 cycles/sec suffices to narrow the width of an absorption line from its value in the absence of that motion. (auth)

2754 Fast Neutron Continuous Monitor and Survey Meter. R. J. Farber. ORNL-590, Mar. 21, 1950. 16p.

This report describes an instrument designed for the dual functions of a continuous duty fast neutron flux monitor and a fast neutron survey meter. The instrument consists of a probe and a power supply chassis, connected by a 12-ft length of cable. Contained in the probe are a recoil proton proportional counter, amplifier, and pulse counting circuits for both monitor and survey functions and an indicating meter for survey purposes. The power supply chassis contains the low voltage supply, an r-f oscillator-type high voltage supply to develop 2200 v for the counter, and the monitor alarm control tube and relay. The monitor sets off an alarm when the fast neutron flux exceeds a pre-set tolerance level. The survey meter is provided with a count rate meter giving a direct indication of the neutron flux at the counter. This meter has full scale calibrations of 50, 1000, and 10,000 neutrons/cm^2/second. When used with neutrons in the energy range 0.2-10 Mev, the system will respond to neutrons only discriminating against γ radiation up to intensities of 5-10 r per hour.

2755 Coherent Neutron-Proton Scattering by Liquid Mirror Reflection. D. J. Hughes, M. T. Burgy, and G. R. Ringo. Phys. Rev. 77, 291-2(1950) Jan. 15 (Letter to the editor).

A reflection method has been devised which gives the amplitude for coherent neutron-proton scattering very exactly, with only a moderately accurate measurement of the critical reflection angle. In this method, neutrons are specularly reflected from tri-ethyl benzene. A collimated thermal neutron beam (obtained from the Argonne pile) was incident on the liquid surface at an angle of 5.3′. All wavelengths longer than the wavelength whose critical angle is 5.3′ were reflected. This wavelength was then determined by absorption measurements in gold, and also by a second reflection of the neutron beam from a Be mirror. The results do not agree with the scattering amplitude as measured by other workers, and give values for the range of the n-p interaction different from those previously calculated.

2756 Functions Used in Flügge's Method of Predicting Approximate Spatial Neutron Distributions. L. Secrest. Phys. Rev. 77, 141-2(1950) Jan. 1 (Letter to the editor).

A method due to Flügge (Physik. Z. 44, 445-455(1943)) permits the prediction of the approximate spatial distribution of neutrons produced by a point source of monoergetic neutrons in an infinite hydrogenous medium. This method involves the application of the age theory to a source consisting of those neutrons which have made one slowing-down collision. The resulting distribution equation is given. This equation involves functions whose numerical values have been tabu-

lated by Flügge. The author has applied the above method to the analysis of various experimental distributions. In doing so he found it necessary to extend Flügge's tables, adding new values as indicated in the article. The result of the experimental work will be reported at a later date.

2757 Measurement of Fast Neutron Energies by Observation of $Li^6(n,\alpha)H^3$ in Photographic Emulsions. George R. Keepin, Jr., and James H. Roberts. Rev. Sci. Instruments 21, 163-6(1950) Feb.

This article is an amplification of a letter to the editor, which appeared in Phys. Rev. 76, 154(1949). An abstract of the letter was published in Nuclear Science Abstracts as abstract No. 3-1155.

2758 On the Spatial Distribution of Neutrons Slowed Down in Slightly Hydrogenous Media. B. Davison. Atomic Energy Research Establishment Report No. AERE-T/R-334, July 1949. 58p.

In this report the following problem is considered: a plane isotropic source of monochromatic neutrons is situated in a medium stretching to infinity in all directions and composed of a mixture of hydrogen and infinitely heavy nuclei; the "effective proportion" of hydrogen is assumed to be relatively low, at least for the initial energy of neutrons. The method is developed in this report for determining the energy of spectrum and the spatial distribution of neutrons at large distances from the source, i.e., in the region where the age-velocity theory is inapplicable. The method is essentially a successive approximation method with the first approximation corresponding to the assumption that hydrogen, though it slows the neutrons down, scatters isotropically. The application of the method is illustrated on three examples: (1) the scattering and the capture cross sections both of hydrogen and of heavy nuclei are assumed to be constant; (2) the scattering and the capture cross sections both of hydrogen and of the heavy nuclei are assumed to vary according to a 1/v-law; (3) the scattering cross section of hydrogen is assumed to vary according to a 1/v-law, and the scattering cross section of heavy nuclei is assumed to be constant while capture is neglected. The results for these three examples are summarized. (auth)

2759 Resonance Neutron Scattering in Na^{23} at 3000 Ev. C. T. Hibdon, C. O. Muehlhause, W. Selove, and W. Woolf. Phys. Rev. 77, 730-1(1950) Mar. 1 (Letter to the editor). (See also NSA 3-1261.)

Neutron resonance overlapping between sodium and manganese has been observed by using a neutron scattering counter (Phys. Rev. 76, 100(1949)) and an epi-cadmium neutron beam from the Argonne heavy water reactor. With either material serving as scattering detector and the other as absorber about 20% overlapping was observed. That is, about 20% of the scattered neutrons from one material had a transmission cross section of approximately 120 b for the other material. Similarly, when sodium was used as both scattering detector and absorber about 50% of the scattered neutrons had a high transmission cross section. The neutron transmission of sodium as a function of energy was measured with the resonance-region time-of-flight spectrometer (Selove, Phys. Rev. 76, 187(1949)) at the Argonne. The results for the highest resolution are tabulated, and the resonance energy is given as 3000 ± 600 ev.

Spectrometer measurements of manganese show that the resonance overlap was due to a manganese resonance a few hundred ev below the sodium resonance. Several unique features of the sodium resonances are discussed.

2760 Electronics for the Nuclear Physicist. W. C. Elmore. Uspekhi Fiz. Nauk 39, 51-131(1949)(in Russian).

This is a translation of a paper published in Nucleonics 2, 4(1948) Feb.

2761 Interaction Between the Nucleus and its Orbital Electrons. Louis de Broglie, Ed. Paris, Editions de la Revue d'Optique, 1949 (in French). 204p.

The general subject of the interactions between the nucleus and the outer electrons of the atom is treated in several chapters written by various authors. The following classes of phenomena are examined: internal conversion, nuclear isomery, capture of an electron by the nucleus, creation of a new orbital electron by the nucleus (so-called "creation e," not yet observed), the effect of nuclear changes in an atom on the chemical properties of the molecule.

2762 Dependence of the F^{19} Nuclear Resonance Position on Chemical Compound. W. C. Dickinson. Phys. Rev. 77, 736-7(1950) Mar. 1 (Letter to the editor).

It has been found that, for F^{19}, the value of the applied magnetic field for resonance depends on the chemical compound containing the fluorine nucleus. To investigate this effect two identical magnetic resonance absorption bridges, both fed by the same oscillator, were used. The two sample holders were placed side by side in the magnet so that the resonances occurred simultaneously on separate recording milliameters. The maximum separation of resonances observed so far is 1.05 gauss for $C_2F_3Cl_3$ and BeF_2 in a magnetic field of about 7000 gauss. In some cases the resonances for separate samples are not the same as the resonances for mixtures. Resonance positions for six compounds are given. The internal diamagnetic correction has been calculated for the neutral fluorine atom and for the singly charged ion, and these corrections are found to be of the wrong order of magnitude to explain these shifts. Proton resonances were observed in various compounds and no shifts were observed.

2763 The Dependence of a Nuclear Magnetic Resonance Frequency upon Chemical Compound. W. G. Proctor and F. C. Yu. Phys. Rev. 77, 717(1950) Mar. 1 (Letter to the editor).

In the course of measurements of the magnetic resonance frequency of N^{14} the observation was made that this frequency, in liquid samples, depended strongly on the chemical compound in which the N^{14} was contained. The effect is clearly demonstrated by the appearance of two resonances, separated by 1.6 kc in the neighborhood of 3300 kc, corresponding to a field of 10,000 gauss, using a solution of NH_4NO_3 in 2.0 molar $MnSO_4$ as a sample. These resonances presumably arise from the NH_4^+ and NO_3^- complexes, since samples of $NH_4C_2H_3O_2$ and HNO_3 separately give rise to two different resonances whose frequencies approximate those from the sample solution. The separation is four times greater than the line widths measured between points of

maximum slope. Further evidence of a similar nature is presented for other chemical compounds.

2764 New Determination of Several Radii of Heavy Radioactive Nuclei. Salomon Rosenblum and Manuel Valadares. Compt. rend. 230, 384-6(1950) Jan. 16 (in French).

The Gamow theory of α decay permits one to calculate the radii of α emitters if one knows the intensities of the various groups in the fine structure of the α spectrum. If Z and A are even, the quantum number j may generally be taken as zero. On the basis of recent studies of α spectra (Rosenblum et al, Compt. rend. 227, 1088(1948); 228, 385(1949)) the authors have calculated the radii of the nuclei in the radium and thorium series. These radii are plotted as functions of the atomic weights and lie on a smooth curve for each series. Deviations, which are rare, are attributed to an unknown fine structure. The shape of the curves indicates the formation of a completed shell at A = 208 = 126 + 82.

2765 Nuclear Energy Levels in Isotopes of Potassium. Vance L. Sailor. Phys. Rev. 77, 794-8(1950) Mar. 15.

Targets made from the separated isotopes K^{39} and K^{41} were bombarded by 3.90-Mev deuterons, and protons from the nuclear reactions $K^{39}(d,p)K^{40}$ and $K^{41}(d,p)K^{42}$ were observed. The energy distribution of the protons emitted in each reaction was obtained by measuring the proton yield as a function of range. The ground state Q-value for $K^{39}(d,p)K^{40}$ was found to be 5.48 ± 0.08 Mev, giving the mass difference $K^{40} - K^{39}$ = 1.00070 ± 0.00007 mass units. Excited states of K^{40} were found at 0.81, 2.01, 2.56, 3.3, 3.7, 4.2, and 4.8 Mev. The ground state Q-value for $K^{41}(d,p)K^{42}$ was 5.12 ± 0.10 Mev, giving the mass difference $K^{42} - K^{41}$ = 1.00109 ± 0.00010 mass units. Excited states of K^{42} were found at 0.62, 1.18, 1.97, and 2.29 Mev. (auth)

2766 Nuclear Shell Models. Eugene Feenberg. Phys. Rev. 77, 771-6(1950) Mar. 15.

The principal features of the several shell models now under discussions are described briefly. The magnetic moments of odd nuclei have been interpreted as (a) supporting an extreme single particle model (Schmidt limits) and (b) as generally consistent with a uniform model (Margenau-Wigner limits). The evidence is consistent with a composite interpretation based on (a) the approximate validity of the extreme single particle model for nuclei lacking one particle to make a closed shell or possessing one particle in excess of the number making up a closed shell, and (b) the approximate validity of the uniform model for all other odd neuclei. Remarks on quadrupole moments, isomerism, and β decay supplement an earlier discussion. (auth)

2767 On the Low States of Li^7 and Be^7. D. R. Inglis. Phys. Rev. 77, 724-5(1950) Mar. 1, (Letter to the editor).

Recent experiments (Buechner and Strait, Phys. Rev. 76, 1547(1949)) have indicated that no excited states exist in the Li^7 nucleus with energies below about 3.6 Mev, with a similar but more ambiguous situation for the mirror nucleus Be^7. This fact might be interpreted as favoring a return to the original postulate of extreme L-S coupling.

The author, however, cites several arguments for rejecting such a theory, and shows that the j-j coupling scheme need not be discarded. The author's interpretation in terms of j-j coupling requires mainly nonexchange interaction with an additional weak space-spin exchange term. Saturation would then be attained not by exchange but by interactions between three nearly coincident nucleons. Such a saturation phenomenon is characteristic of pair theories of nuclear forces. The type of interaction described also seems necessary to explain the spins of Li^6 and B^{10} in the j-j model.

2768 Reactor Program of Atomic Energy Commission. Current Status and Problems. Lawrence R. Hafstad. Chem. Eng. Progress 46, 109-12(1950) Feb.

This article summarizes the status of development of nuclear reactors and outlines some of the problems. The four reactors on which attention is being focused are: (1) Materials testing reactor for studies of materials to be employed in building reactors. (2) Ship propulsion reactor, a prototype of a reactor for use in propelling submarines. (3) Experimental breeder reactor designed to explore possibilities of producing more fissionable material than is consumed. (4) Intermediate power breeder reactor designed to produce electric power and explore possibilities of breeding. The construction of these reactors has been started recently. The breeding process and the possibility of a "homogeneous reactor" are discussed in some detail.

2769 Radioactive Isotopes of the Rare Earths. III. Terbium Isotopes. Geoffrey Wilkinson and Harry G. Hicks. UCRL-421, Aug. 18, 1949. 19p.

A study has been made of neutron deficient radioactive isotopes of terbium produced by 19, 31, and 38-Mev α-particle bombardment of europium and by 10-Mev proton bombardment of gadolinium using the 60-in. Crocker Laboratory cyclotron. The experimental techniques used in bombardments, chemical separation, and radioactivity measurements have been previously described (Wilkinson and Hicks, Phys. Rev. 75, 1370(1949)). Five new isotopes have been characterized as shown below.

Isotope	Type of radiation	Half-life	Energy of radiation in Mev Particles	γ-rays	Produced by
Tb^{153}	K, e^-, γ	5.1 ± 0.1 days	0.15 ~0.3	L, K x-rays 0.23, 1.2	Eu^{151}-α-2n
Tb^{154}	K, e^-, γ β^+(~0.5%)	17.2 ± 0.2 hours	0.13 ~ 0.8(e^-) 2.6(β^+)	L, K x-rays 1.3	Gd-p-n Eu^{151}-α-n Eu^{153}-α-3n
Tb^{155}	K, e^-, γ	190 ± 5 days	0.1(e^-)	L, K x-rays 1.4	Eu^{153}-α-2n
Tb^{155}	K, β^+(< 25%)	5.0 ± 0.1 hours	~1.3	L, K x-rays	Eu^{153}-α-n Gd-p-n
Tb^{157}	K, e^-, γ	4.7 ± 0.1 days	0.09, 0.2	L, K x-rays 1.4	Gd-p-n

2770 Contribution to the Theory of the Nuclear Photo-Effect. Theodor Sexl. Acta Phys. Aust. 3, 277-82 (1949)(in German).

The effective cross section for the nuclear photoeffect is calculated for the nuclei He^5, Be^9, and C^{13}. These nuclei are assumed to consist of a spinless aggregate of α particles and an unpaired neutron in a p state, and a potential well approximation is assumed for the interaction between the neutron and the rest of the nucleus. Since the depth and the

PHYSICS

radius of the potential well appear in the expression for the effective cross section, it must be possible to determine these constants by measuring the cross section for various incident γ-ray energies. (auth)

2771 Cross Sections for the Photo-Disintegration of Nitrogen and Oxygen Nuclei by 100-Mev Betatron X-rays. E. R. Gaerttner and M. L. Yeater. Phys. Rev. 77, 714(1950) Mar. 1 (Letter to the editor).

Nuclear disintegrations caused by x-rays from the 100-Mev betatron have been investigated with a cloud chamber. The disintegrations studied are those occurring in the filling gas of the cloud chamber; they are observed as single, double (flag), and multiple (star) tracks. The singles are nuclear recoils mostly from (γ,n) processes; according to a preliminary analysis most of the flags in nitrogen result from (γ,pn) reactions; the stars represent various modes of disintegration involving the emission of several charged particles and probably neutrons. Approximate values of the integrated cross sections have been obtained for the flags in air, and for singles, flags, and stars in nitrogen and oxygen, for a peak betatron energy of 100 Mev. The latter measurements show the total integrated photo-disintegration cross sections for nitrogen or oxygen to be ~0.6 Mev-barn.

2772 Fast Neutron Reactions with Fluorine and Sodium. J. V. Jelley and E. B. Paul. Proc. Phys. Soc. (London) 63, 112-25(1950) Feb. 1.

The yields of the (np) and (nα) reactions in fluorine and sodium have been measured by observations on the radioactivity produced by bombardment with neutrons from the (dn) reactions in Li, B, Be, and D. Cross sections have been estimated and methods of deriving the absolute disintegration rates and the neutron flux are described. The reaction energies have also been derived, by assuming a particular form for the excitation function, and using published data on the energy distribution of the neutrons used. (auth)

2773 Mean Free Path of the Particles Produced in Nuclear Explosions and Comparison Between Explosions in C and Pb. A. Lovati, A. Mura, G. Salvini, and G. Tagliaferri. Phys. Rev. 77, 284-5 (1950) Jan. 15.

Preliminary results are reported of a cloud chamber experiment in which the authors determined the mean free path (λ) in lead for nuclear interaction of the penetrating particles of nuclear explosions, and compared the numbers of nuclear explosions produced in nuclei of carbon and lead to provide an experimental choice between the different theories of meson production. After the application of various corrections λ was found to be 350 g/cm^2 ± 30%. The ratio of the number of nuclear explosions with more than four relativistic particles in carbon to that in lead was found to be 0.6 ± 0.3.

2774 Measurements of the Energy of γ Rays Emitted as a Result of a Neutron Capture. M. L. Aleksandrova. Doklady Akad. Nauk S.S.S.R. 69, 763-5(1949)(in Russian).

The determination of the energy spectrum of γ rays following the capture of slow neutrons presents considerable difficulties, due chiefly to the low intensity of the emitted rays. The very few works done, which used a method involving the absorption of secondary electrons, resulted only in a certain mean value of the γ-ray energy (Rasetti, Z. Physik 97, 64(1935); Fleischmann, Z. Physik 103, 113 (1936)). The present author studied the γ emission of the reaction Cd(n,γ) with the aid of thick photoemulsions containing heavy water. A partial replacement of H_2O by D_2O in the previously heated plates was obtained by soaking them in heavy water and drying at room temperature. A plate so treated was placed in a 1 mm thick cadmium box, together with a nontreated control plate recording recoil protons only. The box was immersed in a thick mass of paraffin that was protected by Pb from γ rays of the neutron source. The energy of the γ quanta of the (n,γ) reaction was found from the equation $h\nu = E + 2E_H$, where E is the binding energy of a deuteron, and $2E_H$ is the energy of the resulting protons, which is determined from their ranges in the emulsion. Only tracks ending in the latter and longer than 30 μ were used. The width of the resulting energy curve testifies to a complex γ spectrum; a well-pronounced maximum corresponds to 6.5 Mev; the position of the maximum shows that the transition to the ground state (or a neighboring one) is the most probable. Recently Moak and Dabbs (Phys. Rev. 74, 1249(1948)) studied the same reaction by observing pairs in a Wilson chamber; they found a γ-ray maximum of 5 Mev.

2775 Neutron Capture Gamma-Rays from Be^9, C^{12}, and N^{14}. B. B. Kinsey, G. A. Bartholomew, and W. H. Walker. Phys. Rev. 77, 723-4(1950) Mar. 1 (Letter to the editor).

Materials containing carbon and nitrogen were exposed to a high flux of thermal neutrons in the Chalk River pile. The radiations emitted were examined with the aid of a coincidence pair spectrometer similar to that described by Walker and McDaniel (Phys. Rev. 74, 315(1948)). With a graphite sample in the pile a conspicuous radiation was identified as resulting from neutron capture in C^{12} which must be the direct transition to the ground state of C^{13}. The energy of this radiation is 4.947 ± 0.008 Mev. Averaging this figure with the results of previous measurements, the authors give 4.951 ± 0.006 Mev as the most probable energy. Nitrogen was investigated with the aid of samples of beryllium nitride, urea, and beryllium oxide. From the spectra of these compounds nine radiations due specifically to nitrogen were identified. These energies are tabulated and fitted into a level scheme. From the intensities of the various γ rays, the radiative capture cross section for nitrogen is estimated to be about 100 millibarns. It is noted that the transition to the ground state is surprisingly weak, since it is presumed to be a dipole transition. The neutron binding energies of C^{13} and N^{15} are calculated, and this calculation confirms previous reports of a discrepancy between transmutation and mass spectrographic data.

2776 The Neutrons from the Disintegration of Beryllium by Deuterons. W. D. Whitehead and C. E. Mandeville. Phys. Rev. 77, 732-3(1950) Mar. 1 (Letter to the editor).

Several authors (Evans et al, Phys. Rev. 75, 1161(1949)) have recently reported the discovery of an endothermic neutron group arising from the reaction $Be^9(D,n)B^{10}$, and corresponding to an excitation level in B^{10} at 5.13 Mev. In order to study this group, the authors have bombarded a

PHYSICS

Be target with 1.62-Mev deuterons. The recoil protons produced by the neutrons were recorded by Ilford C_2 plates making an angle of zero degrees with the deuteron beam. Five neutron groups were observed and their energies and Q values are given. The lowest energy group corresponded to an endothermic reaction with a Q of −0.74 Mev. The energy levels in B^{10} are also calculated.

2777 New Radioactive Isotopes Produced by Nuclear Photodisintegration. F. D. S. Butement. Nature 165, 149(1950) Jan. 28 (Letter to the editor).

The author reports the discovery of the following radioactive isotopes, resulting from (γ,n) and (γ,p) reactions upon radiation with 23-Mev x-rays.

Element irradiated	Element chemically identified	Half-life	Probable assignment
Se	As	9 min	As^{79}
Sm	Sm	8 min	Sm^{143} or Sm^{145}
Eu	Eu	15 hr	Eu^{150}
Gd	-	17 min	Gd^{151} or Eu^{159}
Dy	-	22 min	Tb^{162} or Tb^{163}
Er	-	44 min	Ho^{160}
Yb	-	19 min	Tm^{172} or Tm^{173} or Tm^{175}
Hf	Lu	22 min	Lu^{176} or Lu^{179}
Hf	Lu	8 hr	Lu^{178} or Lu^{179}
W	Ta	48 min	Ta^{185}
W	Ta	6 days	Ta^{183}
Os	Re	17 min	Re^{189} or Re^{191}
Pt	Ir	66 min	Ir^{195} or Ir^{197}
Hg	Au	27 min	Au^{201} or Au^{203}

2778 The Ninety-Degree Excitation Function of the Reaction $T(d,n)He_2^4$. D. L. Allan and M. J. Poole. Atomic Energy Research Establishment Report No. AERE-N/R-449, Dec. 1949. 32p.

The symmetrical cross section of the reaction, $D(t,n)\alpha$, has been investigated over an energy range of 100-200 kev for the bombarding tritons. Two methods have been used. First the yield of α particles from a thick heavy ice target was measured per unit charge of incident beam and the variation of cross section deduced from the gradient of this excitation curve and the range-energy relation for tritons in heavy water. The cross section was compared with that for the deuterium-deuteron reaction measured in the same way. In the second method a direct comparison was made between the yield of α particles from the deuterium-triton reaction and the yield of protons from the deuterium-deuteron reaction when a beam containing both deuterons and tritons was passed through a heavy water vapor target. (The energy loss in this target was calculated as only a few hundred electron volts). To do this a simultaneous observation was made of the protons and α particles using the same counter. In both cases the results were similar; the curve giving the ratio between the symmetrical cross sections for the D-t and D-d reactions (at equal relative velocities of the particles concerned) showed a peak in the region of 150-kev energy. Much greater reliance can be placed on the results of the thin target experiment, as a more accurate measurement of the voltage of the set was

PHYSICS

possible at the time of these experiments, and the voltage does not enter critically into the calculation of the cross section, as is the case in the thick target experiment. A brief account is given of the high voltage equipment.

2779 Observation of (γ,T), (γ,D), and (γ, np) Reactions in Boron. F. K. Goward, E. W. Titterton, and J. J. Wilkins. Proc. Phys. Soc. (London) 63A, 172-3(1950) Feb. 1 (Letter to the editor).

In boron-loaded Ilford emulsions, bombarded with γ rays, stars were observed which are consistent with the reactions:

$$B^{11} = H^3 + 2He^4 — 11.1 \text{ Mev} \quad (1)$$

$$B^{10} = H^2 + 2He^4 — 5.8 \text{ Mev} \quad (2)$$

The events are identifiable by an examination of the momentum balance of the particles forming each star, a procedure which gives ready differentiation from "carbon stars," and which, in most cases, makes it possible to assign the events to either reaction (1) or (2). A number of stars were also observed for which the momentum could not be balanced, some of them consistent with the reaction $B^{10} = n + p + 2He^4$—8.0 Mev.

2780 Possible Reactions in the Disintegration of Uranium 235. Luis Bustamante Amir. Rev. facultad quim. U.N.M.S.M. 1, 14-39(1949)(in Spanish).

Possible variants of the U^{235} fission reaction are examined from a purely qualitative point of view, since no adequate data concerning the energy balance of the reactions are available.

2781 Production of C^{15}. Emmett L. Hudspeth, Charles P. Swann, and N. P. Heydenburg. Phys. Rev. 77, 736(1950) Mar. 1 (Letter to the editor).

The authors have used the larger generator of the Carnegie Institute of Washington to bombard C^{14} with deuterons of energy up to 2.8 Mev, in a search for a (d,p) reaction. Following this bombardment a β activity was observed which was attributed to C^{15} produced in such a reaction. The decay of this activity is plotted and the curve indicates a half-life of 2.4 sec. Absorption measurements on the β rays give an upper limit of 8.8 Mev for the β spectrum. These values indicate that the postulated $C^{15}-N^{15}$ decay is a first forbidden transition. The excitation curve for the deuteron reaction is also described.

2782 Theory of the D+D Reactions. Part I. Analysis of The Energy Dependence. F. M. Beiduk, J. R. Pruett, and E. J. Konopinski. Phys. Rev. 77, 622-7 (1950) Mar. 1. (See also NSA 4-2499.)

The variations with energy of the newly extended observations on the D+D reaction products are analyzed. It is found adequate to assume that all these variations, including details of the angular distributions, are due to differences in centrifugal barriers met by different components of the incident deuteron waves. This is found possible only if considerable spin-orbit interaction is allowed for. The possibility is investigated that numerical measures of the interactions can be obtained from the experimental data. Such conclusions as are permitted by the nature of the data are presented. (auth)

2783 The Use of Photographic Plates for Detection of Uranium Fission. Olivier Rochat. Mém. soc.

PHYSICS

Vaudoise sci. naturelles 9, 195-240(1949) Dec. 31 (in Franch).

Photographic plates, previously impregnated with a uranium salt, were irradiated with slow neutrons. By observation of the fission traces and a subsequent determination of the uranium concentration, and effective cross section for U^{235} fission of 580 ± 120 barns was found. Studies were made of the fading of the latent image by UO_2 ions, of the effect of pH concentration, and of the effect of underdevelopment.

2784 Yields and Angular Distributions of Some Gamma-Neutron Processes. G. A. Price and D. W. Kerst. Phys. Rev. 77, 806-9(1950) Mar. 15.

Measurements of γ-n yields for 53 elements have been made using betatron bremsstrahlung with maximum energies of 18 Mev and 22 Mev. The neutron flux was observed by a rhodium detector and compared with a standard Ra-Be neutron source. In the region from Z = 22 to Z = 83 the γ-n yield in neutrons/mole/r of radiation is observed to be $2270Z^{2.1}$ when the bremsstrahlung spectrum has a 22-Mev maximum energy. The regularity of neutron yield as a function of atomic number indicates a definite similarity in the γ-n cross section curves for neighboring heavy elements. The trend of the observed yields is in rough agreement with the yields predicted by Goldhaber and Teller (Phys. Rev. 74, 1046(1948)). Estimates are made of the fractions of thorium and uranium atoms which undergo photofission. Angular distributions of photoneutrons using bremsstrahlung with a 19.7-Mev maximum energy show no spherical asymmetry greater than the probable error for iron and lead whereas deuterium and beryllium have maxima at 90 deg. (auth)

2785 A Device for Determining the Magnetic Plane of Symmetry in a Time-Varying Electromagnetic Field. R. E. Richardson, W. J. Stephan, R. Younkin, and Duane Sewell. UCRL-453, Mar. 30, 1949. 5p.

2786 Procedures in Magnetic Measurements at the University of California Radiation Laboratory, Berkeley. Robert E. Richardson. UCRL-454, Aug. 16, 1949. 29p.

2787 Use of the Characteristics of Permalloy in Detecting a Predetermined Value of Magnetic Field or Current in a Time-Varying Electromagnet. R. E. Richardson, R. L. Shuey, R. Younkin, and W. J. Stephan. UCRL-455, Mar. 24, 1949. 8p.

2788 Method of Operation of the Permeameter. R. E. Richardson. UCRL-456, Jan. 21, 1949. 6p.

2789 Brief Comparative Specifications — Radiation Laboratory Accelerators. Morgan A. Gunst, Jr. UCRL-604, Feb. 1950. 8p.

2790 The Design of Linear Accelerators. J. C. Slater. Uspekhi Fiz. Nauk 37, 317-48, 459-99(1949)(in Russian).

This is a translation of a work published in Revs. Modern Phys. 20, 473(1948). See Nuclear Science Abstracts 1-818.

2791 Magnetic Induction Accelerator with Small X-ray Sources. Donald W. Kerst and Robert Serber (to Board of Trustees of the University of Illinois, Urbana, Illinois). Canadian Patent 462,135, Dec. 27, 1949.

This device consists of a point source feeding electrons into an evacuated annular chamber. The electrons move in a circular orbit because of the action of a magnetic field perpendicular to the plane of the annular chamber. This field also exerts a stabilizing influence, forcing the particles to oscillate about an equilibrium orbit. Increasing the field strength accelerates the particles, increasing the orbital radius until the electrons strike a target. Since the target is smaller than the amplitude of the oscillations, many of the particles will make several revolutions before hitting it, gaining energy in each revolution. X-rays will then be produced in the target.

2792 On the Theory of the Acceleration of an Electron in a Magnetic Alternating Field. I. (Contribution to the Theory of the Rheotron or Betatron). J. Picht. Optik 6, 40-55(1950) Jan. (in German).

An exact mathematical treatment is given of the motion of an electron in the field of a betatron. The electromagnetic equations are expressed in terms of the Hertz vector Z. Special attention is paid to the conditions under which the orbit of the electron will be stable.

2793 Validity of Two-dimensional Design of Synchrotron Pole-Faces. J. J. Wilkins. Proc. Phys. Soc. (London) 63A, 177-8(1950) Feb. 1 (Letter to the editor).

Synchrotron pole-face designs aim at producing a field between the magnet poles such that, in cylindrical polar coordinates, $-(r/H_z)(\partial H_z/\partial r) = n$, where H_z is the axial field component and $n \simeq 0.7$. The author carried out design calculations by a relaxation method, employing a two-dimensional approximation. The conclusion is reached that this approximation is valid and that the associated experimental two-dimensional method of electrolytical tank measurements (Peierls, Nature 158, 831(1946)) is sufficiently accurate for investigations of the magnetic field between the pole-faces.

2794 Relative Ionization in Various Gases by Alpha Particles from a Thick Uranium Source. H. H. Rossi. AECD-2799, Mar. 1, 1949, Decl. Mar. 6, 1950. 18p.

Relative values of the average energy expended by α particles in the production of an ion pair were obtained. The method consisted in measurements of the total gas ionization due to α particles emitted by a uranium source. The data obtained were in substantial agreement with values given in the literature. Slight deviations in the case of hydrocarbons are attributed to the low average α energy. (auth)

2795 Monte Carlo Methods for Shield Computation. G. Goertzel and H. Kahn. AECD-2807, Feb. 22, 1950, Decl. Mar. 17, 1950. 11p.

There is at the present time no reliable method available to compute the attenuation of a shield. In this report the application of the Monte Carlo method to this problem is discussed. First the basic method is described; then modifications are proposed in order to reduce this random sampling procedure to manageable proportions so that a penetration calculation can be carried out.

PHYSICS

2796 A Proposed Particle Attenuation Problem. G. Goertzel. AECD-2808, Feb. 22, 1950, Decl. Mar. 17, 1950. 36p.

A practical method is presented in detail for applying stochastic (Monte Carlo) methods with quota sampling to an attenuation problem concerning the transmission of particles through a slab of homogeneous and isotropic material. After a discussion of background material, a specific computation set-up is given. This is sufficiently detailed so that an actual computation may be prepared.

2797 Summary of the Research Progress Meeting of December 22, 1949. Henry P. Kramer. UCRL-575, Feb. 14, 1950. 7p.

Transition Curves in Lead. X-rays Causing Nuclear Reactions. In order to measure the resonance energies for various nuclear mutations induced by x-rays, a series of foils of different materials were sandwiched between lead plates and exposed to the x-ray beam from the synchrotron at maximum energies of 335 Mev and 214 Mev. The activities induced in the foils were counted and recorded as functions of the thickness of lead preceding the foil as shown for the reaction $Cu^{63}(\gamma,n)Cu^{62}$. Relative yields, peak energies, and total cross sections relative to carbon are included for a number of materials for which cross sections have been measured. Two nuclear processes are of importance in an attempt to interpret transition curves. Photons of all energies produce positron-electron pairs with a frequency that is a function of their energy. Electrons that are formed through pair production are capable of again releasing photons by bremsstrahlung. The problem has also been considered from a theoretical standpoint.

2798 A Calculation of the Energy Absorbed in a Spherical Volume Containing a Gas-Radon Mixture. Charles R. Maxwell and Victor P. Henri. J. Chem. Phys. 18, 207-10(1950) Feb.

A graphical method for the calculation of the energy absorbed from the α particles emitted by radon and its decay products is described. Factors, calculated by this method, are presented for use in calculating the energy absorbed in any spherical volume. These factors are compared with similar factors calculated with analytical expression presented by other investigators. The orders of magnitude of the energy absorbed from recoil atoms, β particles, and γ rays are given. (auth)

2799 Concrete as a Protective Barrier for Gamma Rays from Cobalt-60. Robert J. Kennedy, Harold O. Wyckoff, and William A. Snyder. J. Research Natl. Bur. Standards 44, 157-62(1950) Feb.

The broad-beam and narrow-beam attenuation of Co^{60} γ rays has been investigated experimentally. In protective barriers the geometry necessarily requires the use of broad-beam attenuation curves to determine the required barrier thickness. This paper presents attenuation curves for lead, concrete, and steel necessary for determining the required protection for any particular cobalt source in storage or transportation. There is also included a table for shielding requirements for Co^{60} sources of 10 mc to 2 curies. (auth)

2800 An Examination of the Single Scattering of Electrons by Nuclei. Walther Bothe. Z. Naturforsch. 5a, 8-10(1950) Jan. (in German). (See also NSA 4-555.)

The single scattering of electrons with energies 210 kev and 370 kev by foils of polystyrol collodion, Al, Ni, Ag, and Au was measured by a method described previously (Bothe, Z. Naturforsch. 4a, 88(1949). Scattering angles from 90 to 130 deg were included in the measurements. It was found that the dependence of the scattering cross section differed beyond the limits of experimental error from that predicted theoretically.

2801 Experimental Verification of the Theory of Elastic Scattering of Fast Electrons. I. I. Yamzin and Z. G. Pinsker. Doklady Akad. Nauk S.S.S.R. 65, 645-8(1949)(in Russian).

In a crystalline body, the elastic scattering of electrons by individual atoms is complicated by the interaction between the electron wave and the periodic field of the crystal lattice; the analysis of the resulting phenomenon, with the purpose of testing the scattering theories, presents considerable experimental difficulties. One method is based on the fact that in the dynamic theory the intensity of an interference maximum in a monocrystal is proportional to the structure amplitude, whereas in the kinematic theory it is proportional to the square of that magnitude. Measurements, made by several writers, of the intensities of maxima on electronograms obtained from various metals, gave contradictory results (Mark et al, Z. Physik 60, 741 (1930); Ornstein et al, Physika 5, 693(1938); Tol et al, Physica 7, 685(1940); v. Friesen et al, Arkiv Mat. Astron. Fysik 33, A.H. 4, No. 20(1947)). The present authors made similar measurements using thin polycrystalline membranes of Al, Cu, Ag, Au, β-Sn, Zn, and Mg. For these metals, which cover a wide range of atomic weights, and for electrons (of 38-56 kv energy) traversing metal layers $\sim 5 \times 10^{-8}$ cm thick, the kinematic theory of scattering in crystalline lattices seems to account satisfactorily for the observed facts.

2802 Inelastic Scattering of Electrons by Molecular Hydrogen. Ernest Addison Jones. In Abstracts of Dissertations Presented by Candidates for the Degree of Doctor of Philosophy, 1947-48. Columbus, Ohio State University, 1949. pp.293-300.

The work described in this paper may be divided into seven parts: (1) The method for treatment of the pressure dependence of scattering has been extended to take in both atomic and molecular scatterers. (2) A new and improved wave mechanical treatment of the 1^1S-2^1P transition of helium has been carried out. (3) Total absorption coefficients for hydrogen have been measured for the energy range investigated. (4) Inelastic cross sections have been measured for the 12.7 electron volt hydrogen excitation. (5) The optical oscillator strengths have been calculated from scattering data for all transitions in hydrogen. (6) The accuracy of the optical oscillator strengths was tested by calculating the polarizability and diamagnetic susceptibility and testing the oscillator sum rule. The f's are used to calculate the proportionality constant in the Van der Waal's interaction energy between hydrogen. (7) A maximum in the scattering curve is related to an ionization process. (auth)

2803 Polarization of Annihilation γ Quanta. N. A. Vlasov and B. S. Dzhelepov. Doklady Akad. Nauk S.S.S.R. 69, 777-9(1949)(in Russian).

PHYSICS

Both theory and experiment show that the annihilation of pairs with the production of two oppositely directed quanta should be considered as predominant under the usual conditions; the theory predicts also that the two quanta are polarized in perpendicular planes. (Pomeranchuk, Doklady Akad. Nauk S.S.S.R. 60, 213(1948)). The latter conclusion can be tested by counting coincident γ rays or photoelectrons scattered by both quanta in directions forming certain angles between them; in the case of a perpendicular polarization, the maxima of the numbers of coincidences should occur at angles equal to 90 deg. Under the direction of Lukirskiĭ, such tests were made in 1947; however, their statistical accuracy was unsatisfactory, and new experiments, described here, were done in 1948; in the meantime Bleuler et al (Phys. Rev. 73, 1398(1948)) and Hanna (Nature 162, 332(1948)) reported on similar works. In the arrangement used by the present authors, the positron source, wrapped in a metal foil, was placed in the middle of a channel piercing a Pb block; at both ends of the channel Al scatterers received the annihilation γ quanta; the scattered rays were caught by two plane groups of counters, (one group beside each scatterer); coincidences of pulses at both ends were recorded at various mutual positions of the two counter groups. The background coincidences were found to be $<30\%$. As a result, the value 1.7 ± 0.2 was obtained for the ratio between the numbers of coincidences in the perpendicular and the co-planar positions of the two counter groups. Although the geometry of the instrument was not precise enough to permit the above result to be used for a quantitative checking of the theory, this result's qualitative value, as a positive answer to the question of the polarization, is obvious.

2804 Reactive Corrections for the Elastic Scattering of an Electron. Shinji Endô, Tôichirô Kinoshita, and Zirô Koba. Progress Theoret. Phys. 4, 218-29 (1949) Apr.-June.

This paper is an amplification of a letter to the editor, which appeared in Progress Theoret. Phys. 3, 320(1948) and was abstracted in Nuclear Science Abstracts as No. 4-314.

2805 High Energy Gamma Ray Penetration in Lead. W. Earl White. NEPA-1324, Mar. 6, 1950. 10p.

When a neutron is captured by a nucleus, one or more γ rays will be emitted which in some cases possess energies as high as 20 mc^2. There has been some apprehension that showers of γ rays greater than 2 mc^2, which are produced by processes of pair production and bremsstrahlung production from these high energy γ rays could become significant in shielding considerations. The problem is considered mathematically, and the results show that γ showers produced by high energy γ rays do not occur in sufficient numbers to warrant serious consideration.

2806 The Half-Life of Po^{208}. D. H. Templeton. UCRL-616, Feb. 27, 1950. 6p.

Two samples of a mixture of Po^{208} and Po^{210}, mounted on platinum, have been observed for 3 years in order to establish the half-life of Po^{208}. Decay measurements were made with ionization chamber type α-counters. If a correction of 0.03 years is made for the diffusion error, the final result for the half-life of Po^{208} is 2.93 ± 0.03 years. The probable error includes estimates of the reliability of the counting rates and of the corrections for diffusion and for the other polonium activities. It has been assumed that loss of polonium from the samples has not occurred.

2807 The Angular Correlation of Scattered Annihilation Radiation. C. S. Wu and I. Shaknov. Phys. Rev. 77, 136(1950) Jan. 1 (Letter to the editor).

J. A. Wheeler (Ann. N. Y. Acad. Sci. 48, 219(1946)) has proposed an experiment to verify a prediction of pair theory, that the two quanta emitted in the annihilation of a positron-electron pair, with zero relative angular momentum, are polarized at right angles to each other. This suggestion involves coincidence measurements of the scattering of both the annihilation photons at various azimuths. The predicted maximum asymmetry ratio of coincidence counts when the two counters are at right angles to each other to coincidence counts when the counters are co-planar is as large as 2.85 and occurs at a scattering angle of $\theta = 82$ deg. Hanna (Nature 162, 332(1948)) found that the observed asymmetry ratios are consistently smaller than those predicted. Similar experiments have now been carried out by the authors, using scintillation counters as γ detectors. The experimental technique is described in detail, and should be much more reliable than previous methods. The results are in good agreement with theoretical predictions.

2808 The beta-spectrum of Be^{10}. H. W. Fulbright and J. C. D. Milton. Phys. Rev. 76, 1271-2(1949) Oct. 15 (Letter to the editor).

The β decay of Be^{10} has a particular interest at this time because the transition $Be^{10} \rightarrow B^{10}$ is now known almost certainly to involve a spin change of three units, so that the transition is highly forbidden according to the Fermi theory of β decay. The shape of the Be^{10} spectrum has been determined by means of a high pressure proportional counter in which the sample was mounted on a 0.2 mg/cm^2 aluminum foil suspended between two tungsten collector wires, so that all electrons emitted would be observed. The plot of the spectrum as forbidden (using Marshak's D_2 correction curve) is a straight line, supporting the Fermi theory.

2809 The Beta-Stability of Heavy Nuclei. Svante Nordström. Z. Naturforsch 5a, 6-8(1950) Jan. (in German).

The author applies the stability rules for nuclei as formulated by J. Mattauch (Naturwissenschaften 19, 194(1940)) to the data of G. T. Seaborg and J. Perlman (Rev. Modern Phys. 20, 585(1948)) to determine which nuclei in the region of α-emitters are pure α-emitters, and those which are also β-active. A diagram summarizes the results for nuclei of atomic weight greater than 206.

2810 An Experimental Determination of the Distribution of the Radon Decay Products in a Gas-Filled Spherical Vessel. Charles R. Maxwell, Victor P. Henri, and Dorothy C. Peterson. J. Chem. Phys. 18, 179-182(1950) Feb.

The distributions of RaC and of (RaA + RaB) between the walls and the gaseous phase of a spherical vessel filled with a gas-radon mixture were determined by the analyses of decay curves of the γ activity of the radon decay products left on the walls of the vessel when it was rapidly evacuated. The distributions of RaA and RaB were determined from

PHYSICS

these data. The effects of the size of the flask, the pressure of the gas, and the type of gas upon these distributions were investigated. It is suggested that the distributions of RaA and RaB when expressed as a function of the distribution of RaC are independent of these variables. The distributions in benzene and in carbon dioxide are reported. (auth)

2811 Low Energy Beta-Ray Spectra: Pm^{147}, S^{35}. L. M. Langer, J. W. Motz, and H. C. Price, Jr. Phys. Rev. 77, 798-805(1950) Mar. 15.

The β spectra of S^{35} and Pm^{147} have been measured in order to study further the nature of any low energy deviation from the Fermi Theory of β decay. Measurements were made with thin, relatively uniform sources in both the 40-cm radius of curvature spectrometer and also in a small 180-deg focusing Helmholtz coil spectrometer designed specifically for low energy spectra. The thinnest sources were less than 10 $\mu g/cm^2$. Using Zapon counter windows ranging from 15 to 3 $\mu g/cm^2$ and also a windowless counter technique, Fermi plots were obtained which showed how the measured distribution of particles at low energy depends on both source and counter window thickness. Favorable experimental conditions yielded a straight line Fermi plot for Pm^{147} above 8 kev. Less favorable conditions resulted in a straight line plot for S^{35} down to at least 50 kev. Thus, S^{35}, which is allowed, and Pm^{147}, which is probably once forbidden, are found to have spectra of the allowed shape. It is concluded that under very favorable experimental conditions there is probably no real disagreement between the observed momentum distribution and that predicted for an allowed transition by the Fermi theory. On the basis of an improved calibration, the following end points are obtained: Pm^{147}, 223.2 ± 0.5 kev and S^{35}, 167.0 ± 0.5 kev. (auth)

2812 The Possible Existence of a Fourth Natural Radioactive Series. J. H. J. Poole, C. F. G. Delaney, and R. C. McCormick. Sci. Proc. Roy. Dublin Soc. 25, No. 9, 101-16(1949) Oct. (See also NSA 4-1154.)

The general position as regards the possible existence in nature of the neptunium or 4n + 1 radioactive series is discussed. The existence in Ytterby mica of unexplained pleochroic halos, discovered by Prof. Joly in 1922,(Proc. Roy. Soc. A. 102, 682(1923)), suggests that the neptunium series may be present in the mica. New measurements of the halos showed fairly definitely that these halos are not produced by the neptunium series. Further experiments on the nature of the radioactivity of Ytterby mica, using both the nuclear plate technique and an ionization chamber α-ray counter, are described. The general result of these is to prove that the neptunium or 4n + 1 series does not exist in the mica, at least in amounts comparable with those of the uranium and thorium series. The paper concludes with a discussion of some peculiarities observed in the range distribution of the α rays emitted by the mica. (auth)

2813 Radioactivity of Potassium. F. W. Spiers. Nature 165, 356(1950) Mar. 4 (Letter to the editor).

The author has measured the γ ray activity of a 2 kg source of $K^{40}Cl$, in the form of a thick cylinder surrounding a steel condenser-ionization chamber (Brit. J. Radiol. 22, 169(1949)). Using two different methods of calibration, the author found 3.0 and 2.9 quanta/sec/g potassium, in good agreement with results previously reported (Gleditsch and Graf, Phys. Rev. 72, 641(1947)). In order to measure the β-ray activity, discs of $K^{40}Cl$ were made by pressing with a little binding material, and placed below the end window of a GM4 Geiger-Mueller tube. The following results were obtained:

Specimen thickness (mm)	1	2	3	4
β-ray activity mμC/g KCl	0.431	0.426	0.438	0.436

Reported half-lives and proposed decay schemes are discussed.

2814 Slow Neutron-induced Activities in Europium and Samarium. J. M. Hill and L. R. Shepherd. Proc. Phys. Soc. (London) 63, 126-36(1950) Feb. 1.

The activities produced by neutron irradiation of europium and samarium have been investigated by means of a thin lens type β-ray spectrometer and by absorption and coincidence methods. The 9.2-hr activity in europium is due to the dual decay of Eu^{152} by β emission and by K capture. The long period activity is due to both Eu^{152} and Eu^{154}, and again both β emission and K capture are present. This long period K capture is due to Eu^{152}, and the β emission is possibly due to both Eu^{152} and Eu^{154}. The energies of the emitted radiations are discussed and possible decay schemes proposed. The 47-hr activity induced in samarium is due to the β decay of Sm^{153}, and measurement of the energies of the emitted radiations has been made. (auth)

2815 Study of the Gamma and X-radiation of Mesothorium I and of Mesothorium II. Marcel Lecoin, Marguerite Perey, and Michel Riou. J. phys. radium 10, 390-4(1949) Dec. (in French).

By the method of selective absorption, it is shown that $MsTh_2$ emits an intense L radiation because of the internal conversion of radiation with energy below 100 kev. The authors have determined the absolute intensity of this L radiation (0.3 quanta per disintegration) and the total intensity of the γ rays with energy greater than 100 kev (two quanta per disintegration). $MsTh_1$ also emits L radiation (0.4 photons per disintegration). This radiation is attributed to the internal conversion of a γ ray of about 30 kev. The electrons in this process have already been observed in a Wilson cloud chamber.

2816 Units of Radioactivity. L. F. Curtiss, R. D. Evans, Warren Johnson, and Glenn T. Seaborg. Rev. Sci. Instruments 21, 94(1950) Jan. (Laboratory and shop note).

The same article appeared as a letter to the editor in Phys. Rev. 77, 142(1950) Jan. 1. The letter was published in Nuclear Science Abstracts as abstract No. 4-1830.

2817 Applicability of Pauli's Regulator to the Gamma-Decay of Neutrettos. H. Fukuda, Y. Miyamoto, T. Miyazima, S. Tomonaga, S. Oneda, S. Ozaki, and S. Sasaki. Progress Theoret. Phys. 4, 477-84 (1949) Oct.-Dec.

Although the Schwinger-Tomonaga formalism seems to fulfill the requirements of relativistic invariance, many results calculated with it turn out to be noninvariant. The authors believe that the reason for this ambiguity lies in the fact that a consistent formulation of the relativistic com-

mutation relations and of the generalized Schroedinger equation can be attained only by using a singular δ function. One such ambiguous case is discussed in detail, namely the γ decay of the neutretto. It is shown that not even Pauli's regulator can remove all ambiguity in the solution of this problem.

2818 Divergence Difficulty and Mixed Meson Theory. II. Gentaro Araki. Progress Theoret. Phys. 4, 34-41 (1949) Jan.-Mar.

This paper is an amplified version of a letter to the editor, which appeared in the Physical Review 74, 985(1948). An abstract was listed in Nuclear Science Abstracts as No. 1-1613.

2819 A Divergence Free Field Theory. Katuro Sawada. Progress Theoret. Phys. 4, 412-19(1949) Oct.-Dec.

A property of commutation relations between field quantities, especially of Δ functions appearing on the right hand side of the commutator of field variables, suggested to the author a generalization of relativistic cut-off procedure developed by Feynman (Phys. Rev. 74, 939, 1430(1948)). Formal simplifications can be obtained by introducing this generalization instead of introducing regulators in the evaluation of integrals. The electromagnetic and scalar meson self-energies of a Dirac particle are calculated according to the author's prescription and found to be finite.

2820 Electron Beams in Axially Symmetrical Electric and Magnetic Fields. C. C. Wang. Proc. I.R.E. 38, 135-47(1950) Feb.

The problem considered in this paper is the formulation of the equations governing the motion of an electron beam in axially symmetrical magnetic and electric fields. The equations are obtained for the trajectories of the electrons along the outer edge of the beam for the most general case, in which there are both axial and radial components of the fields. It is shown that, as a result of symmetry, the combined effects of the electric and the magnetic fields can be expressed as a single generalized potential function which depends only on the axial and radial space co-ordinates. This permits one to express the axial and radial force components as the axial and radial components of the gradient of this potential function. The author discusses the trajectories obtained by numerical integration of the equations of motion. (auth)

2821 Irreversible Processes and the Formation of Nuclei. G. Wataghin. Nuovo cimento 6, Sup. 241-3(1949).

The author applies the theory of thermodynamical equilibrium conditions to an assembly of matter (nucleons, electrons, mesons, and nuclei) and radiation in a state of rapid expansion at temperatures $kT \sim 10^7$ ev and densities $\rho \sim 10^{12}$ gm/cm^3. Three parameters appear in the final result, and their values may be determined from the observed cosmic abundances of the various particles. On the basis of this result, the author examines the hypothesis that the nuclei were formed inside stars at an early period in stellar history, and that cosmic rays have their origin in the prestellar state of matter, a state of explosive expansion. It is found that neutrinos could not have come into equilibrium with the other particles during the short time when conditions were favorable for the formation of nuclei, and that a

theory of irreversible processes must be used for a more satisfactory calculation. The details of such a calculation will be published later. This paper is one of a series presented at the International Convention on Statistical Mechanics held at Firenze in May, 1949.

2822 Non-Localizable Fields and Reciprocity. M. Born. Nature 165, 269-70(1950) Feb. 18.

The author has previously suggested the following ideas (Proc. Roy. Soc. Edinburgh 62A, 40, 92, 127(1944)): (1) The principle of nonlocalizability of fields, which rejects the introduction of coordinates and time as independent parameters on which the field operators depend, but proposes instead to treat coordinates and time as observables, represented by operators, and to characterize the space-time dependence of the field quantities by commutation rules. (2) The principle of reciprocity, according to which the fundamental equations of physics are symmetrical in space-time and momentum-energy. It is pointed out that Yukawa's theory of nonlocalizable fields is equivalent to a successful combination of these two ideas, which thus gain greatly in plausibility. It follows from Yukawa's work that it is legitimate to postulate the simultaneous validity of both reciprocal wave equations in x-space and p-space for nonlocalized fields because, by the nature of the commutators, they split automatically into two sets, one referring to the internal structure, the other to the resultant motion.

2823 On the Asymptotic Distribution of Eigenvalues. J. S. de Wet and F. Mandl. Proc. Roy. Soc. (London) 200A, 572-80(1950) Feb. 22.

The asymptotic distribution of the eigenvalues of the one-dimensional Schroedinger equation is provided by the so-called W.K.B. formula. Most proofs of this depend on the approximate solution of the equation in two regions and the joining up of these solutions at the boundaries of the regions in a certain way. These methods are not easily generalized to the Schroedinger equation for dimensions greater than one. In the present paper the methods of Courant and Hilbert (Methoden der Mathematischen Physik, vol. 1. Berlin: Springer, 1931. Second ed.) are applied to this problem and they lead very simply to a proof of the known result in one dimension and to analogous formulae for the eigenvalue distribution of the Schroedinger equation in two and three dimensions. (auth)

2824 On the Calculation of Self-Energy of Particles. Suraj N. Gupta. Phys. Rev. 77, 294-5(1950) Jan. 15 (Letter to the editor).

It has been shown that the self-energy of particles may be obtained in a covariant form by using an invariant perturbation theory developed by Tomonaga, Schwinger, Feynman, and others. However, the author finds that the covariant self-energy may be obtained even with the ordinary perturbation theory by using a generalization of a transformation due to Pauli and Rose (Phys. Rev. 49, 462(1936)). Using this type of transformation, the author calculates the self-energy of nucleons due to the pseudoscalar and vector meson fields with the Moller-Rosenfeld-Schwinger mixture of couplings. This self-energy is written as a sum of two terms, one of which may be absorbed by a renormalization of the mass of the nucleon, while the other disappears when Feynman's regularization (Phys. Rev. 74, 1430 (1948)) is carried out.

PHYSICS

2825 On the Dirac's Indefinite Metric Space. Naomi Shôno and Nobuo Oda. Progress Theoret. Phys. 4, 358-63(1949) July-Sept.

The authors investigated the mathematical foundation of the indefinite metric introduced by Dirac (Proc. Roy. Soc. (London) 180A, 1(1942)) and discussed by Pauli (Revs. Modern Phys. 15, 175(1943)). It is shown that this metric is the only one in which the total energy operator has diagonal form in the representation characterized by the numbers of positive and negative energy oscillators in various states.

2826 On the Energy Level Shifts of Atoms Due to the Interaction Between the Electron and the Magnetic Field. Osamu Hara and Takasi Tokano. Progress Theoret. Phys. 4, 103-12(1949) Apr.-June.

This paper is an amplified version of a letter to the editor, The Electromagnetic Shift of Energy Levels, which appeared in Progress Theoret. Phys. 3, 316(1948). An abstract was listed in Nuclear Science Abstracts as No. 4-324.

2827 On the Kinetics of Electrons in Electromagnetic Fields. E. A. Vaĭnrib and G. V. Spivak. Doklady Akad. Nauk S.S.S.R. 59, 663-6(1948)(in Russian).

In a previous note (Doklady Akad. Nauk S.S.S.R. 59, No. 3 (1948)) the authors have investigated the behavior of a system of charged particles in a stationary or slowly changing electric and magnetic fields, and have derived certain criteria of a nonequilibrium distribution of the particles' velocities. In the present paper the method is applied to a study of the influence of a magnetic field on the distribution function of electrons in a discharge tube, the linearized function thus found being confronted with that calculated from the kinetic equation; conditions are shown when deviations from a Maxwell, or any other, equilibrium distribution are to be expected. Various other problems involving statistical aggregates can be solved by the method described; thus the results of Lorentz' classical computations and the functions of Gans, (Ann. Physik 20, 293(1906)) and Sommerfeld (Z. Physik 47, 1, 43(1928); Revs. Modern Phys. 3, 1(1931)) are obtained by linearizing the general solutions found in the present work.

2828 On the Meson Theory of Nuclear Forces. Gentaro Araki. Progress Theoret. Phys. 4, 193-200(1949) Apr.-June.

The content of this article was already reported in Physical Review 75, On the Difficulty of the Meson Theory of Nuclear Forces, 1001(1949) and On the Vector and Pseudovector Theories of Nuclear Forces, 1262(1949). These letters to the editor were abstracted in Nuclear Science Abstracts as Nos. 2-1985 and 2-2187.

2829 On the Probability of Meson Transformations. A. Z. Dolginov and S. V. Izmaĭlov. Doklady Akad. Nauk S.S.S.R. 68, 261-3(1949)(in Russian).

A quantum-mechanical examination of the probabilities of the decay of charged mesons into lighter mesons leads to the following classification: I. Disintegration into two particles: (a) the primary A and one of the secondaries B have equal spins, while the other secondary C has an integral spin; A and B are considered as two states of one particle, and C is treated as a quantized wave field; here belong

PHYSICS

emissions of integral-spin neutral particles, and emissions of mesons by charged particles; (b) a primary of integral spin disintegrates into two secondaries of equal spin. II. Disintegration into several particles: (a) transformation of A into B is accompanied by the creation of C, D, etc.; the β decay is usually examined according to this scheme; (b) a meson of spin ½ disintegrates into particles with spins ½ and 0; (c) a charged meson of spin 1 disintegrates into a meson of spin 0 and a photon or a neutretto; (d) a meson of spin 0 decays into a meson of spin 0 and a neutretto of spin 0; the last two cases (c) and (d) are considered with the aid of the formalism of Kemmer (Proc. Roy. Soc. (London) 173A, 91(1939)).

2830 On the Production of π Mesons in Nucleon-Nucleon Collisions. Shuji Takagi. Progress Theoret. Phys. 4, 557-64(1949) Oct.-Dec.

The emission of π-mesons in nucleonic collisions is investigated assuming an interaction between the nucleonic field and the pseudoscalar field representing the π-mesons. In low energy collisions the creation of π-mesons occurs mainly by a process analogous to Bremsstrahlung and the cross section is essentially the same if a phenomenological form is adopted for the nuclear force operator. In high energy collisions it is found that low energy mesons are produced in the same process as in low energy collisions. On the other hand, high energy mesons are created in processes which arise from the pure pseudovector coupling. With respect to the angular distribution, low energy mesons are produced symmetrically in the center of mass system, while the high energy mesons are emitted mainly in the direction of collision.

2831 On the Quantification of the Metric Field and the Particle-Field Interactions. I. Application to the Electric Field. Antonio Giao. Compt. rend. 230, 278-80(1950) Jan. 16 (in French).

On the basis of a unified field theory (Phys. Rev. 76, 764 (1949); J. phys. radium 10, 240(1949)) the author has devised a method of quantizing the metric field which leads directly to the new potentials introduced by De Broglie (Compt. rend. 229, 157(1949); Phys. Rev. 76, 862(1949)) and which, the author believes, may clarify the properties of particles, and of electrical and nuclear forces.

2832 On the Theory of Scattering in a Central Field. O. B. Firsov. Doklady Akad. Nauk S.S.S.R. 68, 241-4(1949)(in Russian).

The phase of the scattering in a field with a central symmetry is calculated in the Born approximation. Conditions are derived which furnish evaluations of applicability of Born's approximation that are more accurate than those usually obtained. The case of a fast particle is separately treated. For a bound particle a convenient expression is given for an approximate determination of the deepest energy level for a given l.

2833 Phase-Shift Formula for Many-Body Collisions. R. Kolodziejski. Nature 165, 110-11(1950) Jan. 21 (Letter to the editor).

The author treats the scattering of a particle by a nearly spherically symmetrical system of particles, taking into account the deformation of the scattering system during

PHYSICS

collision. In the time-dependent Schroedinger equation for the entire system, the interaction potential is replaced by an effective potential obtained by averaging the interaction potential over the different angular orientations of the scattering particles with respect to each other. The solution of this equation is expanded into a series of spherical harmonics referring to the angular coordinates of the incoming particle, and the coefficients of this expansion are obtained by substitution back into the original Schroedinger equation. The phase shift of the scattered wave function is obtained by considering the asymptotic behavior of this solution at large distances.

2834 Relativity and Statistics. André Mercier. Proc. Koninkl. Nederland. Akad. Wetenschap. 53, 50-58 (1950)(in French).

The author shows, by an analysis of existing theories, that the generalization of classical mechanics based on the relativity theory and the generalization based on canonical relations furnish two quantification procedures. The title is to be understood as referring primarily to the canonical features of statistics. The fact that the canonical procedure is connected with statistical requirements relating to the finite cells in phase space leads the author to suspect a double origin, relativistic and statistical, of quantum phenomena. The relativistic and statistical principles seems to be related on a philosophical level through the intermediary of "the principle of insufficient grounds" (le principe d'absence de raison suffisante).

2835 The S-Matrix for Meson-Nucleon Interactions. P. T. Matthews. Phil. Mag. 41, 185-95(1950) Feb. (See also NSA 4-352.)

The possibility is considered of obtaining a divergence free S-matrix for the interactions of mesons with nucleons along the lines of mass and charge renormalization, which Dyson (Phys. Rev. 75, 486, 1736(1949)) has successfully applied to quantum electrodynamics. It has been shown that this can be done for the vector interaction of neutral vector mesons (Phys. Rev. 76, 1254(1949)). The procedure is here extended to the scalar interactions of scalar and pseudoscalar mesons but proves to be quite inadequate to remove all the divergences in the other cases. (auth)

2836 The Scattering of Light by Light. J. C. Ward. Phys. Rev. 77, 293(1950) Jan. 15 (Letter to the editor).

F. J. Dyson (Phys. Rev. 75, 1736(1949)) has shown that the divergencies which occur in quantum electrodynamics may be consistently eliminated by the use of mass and charge renormalization, to all orders of approximation. One of the processes which might be thought to give rise to divergencies and which has to be discussed is the scattering of light by light. The divergence may be isolated in a logarithmically divergent integral which is not gauge invariant, and it is conjectured that this term vanishes for reasons of symmetry as is the case to lowest order in e^2. A formal proof is given in Dyson's notation of the vanishing of this integral.

2837 Some General Formulae Relating to Vacuum Polarization. H. Umezawa and R. Kawabe. Progress Theoret. Phys. 4, 423-42(1949) Oct.-Dec.

PHYSICS

General formulae are derived for various quantities appearing in the problem of the vacuum polarization. The perturbation calculations are performed by an improved method described elsewhere (Progress Theoret. Phys. 4, 420(1949)). The authors discuss the current induced by an external current, and the contribution of the vacuum polarization to elastic and Compton scattering.

2838 The Theory of Atomic Collisions. N. F. Mott and H. S. W. Massey. Oxford, Clarendon Press, 1949 (2nd Edition). 388p.

This book is a comprehensive treatise on the application of quantum mechanics to the theory of collisions between atoms, electrons, and nuclei. All the material on nuclear collisions is new and was not contained in the first edition (1933). Furthermore, relativistic scattering processes not involving radiation and the validity of several approximations are discussed in more detail, and hints are given concerning numerical procedure. Finally, the references to the literature, both experimental and theoretical, have been brought up to date.

2839 Theory of the Interaction of Elementary Particles. IV_1. The Problem of Vacuum Polarization (1). Hiroomi Umezawa, Jirô Yukawa and Eiji Yamada. Progress Theoret. Phys. 4, 25-33(1949) Jan.-Mar. (See also NSA 4-346 and 4-2500.)

The self-energy of a photon was calculated taking into account the existence of various sorts of charged particles. Fermi particles and charged scalar (or pseudoscalar) particles must be assumed to exist in a relative abundance 1:2, while the existence of vector (or pseudovector) particles is forbidden if the self-energy is to be finite. A similar mixture failed to make the self-energy of the C-meson finite. Finally, the authors studied, as a simple case of collision process involving vacuum polarization, the divergence appearing in the fourth order approximation of Compton scattering, taking the existence of the various charged particles mentioned and the C-meson into account. The result was that among the three types of diverging terms appearing when only the interaction between photons and electrons is considered, two vanish and only that proportional to e^3 remains.

2840 Theory of the Interaction of Elementary Particles. IV_2. The Problem of Vacuum Polarization (2) Hiroomi Umezawa, Jirô Yukawa, and Eiji Yamada. Progress Theoret. Phys. 4, 113-20(1949) Apr.-June. (See NSA 4-346; 4-2500.)

The authors carried out fourth order perturbation calculations for Compton scattering in order to see whether the existence of Fermi particles and scalar or pseudoscalar mesons with a relative abundance of 1:2 is effective against divergences due to vacuum polarization appearing in problems involving collision processes.

2841 Vacuum Polarization Due to Various Charged Particles. H. Umezawa and R. Kawabe. Progress Theoret. Phys. 4, 443-60(1949) Oct.-Dec.

The authors employ previously obtained formulae appearing in the problem of vacuum polarization independently of the type of charged particles (Progress Theoret. Phys. 4,

PHYSICS

423(1949)). These results are here applied to charged spinor, scalar, and vector fields. The calculations are made relativistically invariant by a procedure described earlier (Progress Theoret. Phys. 4, 420(1949)). They lead to some new divergence difficulties for the Schwinger-Tomonaga theory.

2842 The Width of an Atom's Energy Levels with Large Quantum Numbers. O. B. Firsov. Doklady Akad. Nauk S.S.S.R. 69, 357-9(1949)(in Russian).

The problem of perturbations produced upon an electron's orbit by molecules of a foreign gas is examined. Starting with considerations on the wave function of the electron, a formula is derived in which the half-width of energy levels of large quantum numbers n, for high densities p of the perturbing gas, is proportional to $p^{1/2}$ and inversely proportional to n^3. As a consequence, the width of spectral lines, for very large n, does not depend on n. The relationship of these findings to Fermi's (Nuovo cimento 11, 157(1934)) treatment of the subject is discussed, as well as to the experimental data of Margenau and Watson (Revs. Modern Phys. 8, 22(1936)) and Füchtbauer (Physik. Z. 35, 975(1934)).

2843 Use of Artificial Radioactive Isotopes as Tracers. H. Neuert. Arch. tech. Messen No. 163, 62-4(1949) Aug. (in German).

The author outlines the principles involved in the use of radioactive tracers. He then describes several counter circuits which may be conveniently used in conjunction with tracer techniques, and gives several examples of the applications of tracer methods in physics, biology, and metallurgy.

AUTHOR INDEX

For each reference the digit preceding the dash is the volume number and digits after the dash are the abstract number

ALEKSANDROVA M L
4-2774
ALFIN-SLATER R B
4-2722
ALLAN D L
4-2778
ALLDREDGE L R
4-2684
ALLEN J G
4-2531 4-2541
AMIR L B
4-2780
ANDREWS G A
4-2538
ARAKI G
4-2818 4-2828
ARVY L
4-2511
ATCHISON G J
4-2637
AZERAD E
4-2591

BACLESSE F
4-2572
BADIN E J
4-2587
BAIR J K
4-2735
BARKER K H
4-2706
BARKLEY L B
4-2640
BARTHOLOMEW G A
4-2775
BAUD J
4-2547
BEAMER W H
4-2637
BECKER R M
4-2522
BEIDUK F M
4-2782
BENAVENTE E P
4-2678
BENNETT L R
4-2540
BENNETT W H
4-2728
BENNISON B E
4-2513
BERGSTROM I
4-2717
BEST M M
4-2556
BILLINGTON D S
4-2669
BINDER W O
4-2673
BISHOP E
4-2634
BLADY J V
4-2546
BLOOM L R
4-2713
BLUMEL J
4-2507
BOIFFARD J A
4-2511
BOLLMAN J L
4-2623
BORN M
4-2822
BOTHE W
4-2742 4-2800
BOURSNELL J C
4-2745
BOUTARIC A
4-2662
BOWEN W A JR
4-2685
BRODA E
4-2734
BROMLEY D
4-2744
BROOKS L M
4-2623
BROWN F W III
4-2648
BROWN R
4-2699

BURGY M T
4-2755
BURRELL R C
4-2624
BUTEMENT F D S
4-2777
BUTLER C C
4-2706

CALVIN M
4-2587
CAMERINI U
4-2699
CARPENTER O S
4-2729
CARTER C E
4-2652 4-2653 4-2654
CAYER D
4-2610
CHAKRABORTY I L
4-2701
CHAMBERLAIN W E
4-2534
CHAMBERS F W JR
4-2710
CHAPIRO A
4-2650
CHATTERJEE S D
4-2701
CHERDYNTSEV V V
4-2668
CHERENKOV P A
4-2693
CHOWDHURI B
4-2692
CHRISTENSEN F E
4-2749
CHRISTIAN J E
4-2798
CHUVILO I V
4-2693
CLARKE T H
4-2552
CLAY H L
4-2556
COATNEY G R
4-2513
COE W S
4-2556
COHN W E
4-2652 4-2654
COLLINS C G
4-2666
CONGER A D
4-2504
CORNATZER W E
4-2610
COULTER M
4-2540
COUSIN C
4-2650
COUTIAUX P
4-2617
CRONKITE E P
4-2514
CROSBIE J M
4-2541
CUDNEY L F
4-2709
CURTISS L F
4-2816

DANIELS F
4-2718
DAVIDGE P C
4-2638
DAVIDSON N
4-2732
DAVISON B
4-2758
DEAN L A
4-2635
DEBROGLIE L
4-2761
DECKER K
4-2549 4-2550
DELANEY C F G
4-2812
DELISLE L
4-2676

DEWET J S
4-2823
DEYE R W M
4-2627
DIBELER V H
4-2724
DICHTEL W J
4-2684
DICKINSON W C
4-2762
DIETHELM L
4-2529
DILLON B
4-2545
DIMMICK G L
4-2688
DITTRICH W
4-2509
DOLBEAR W N
4-2690
DOLGINOV A Z
4-2829
DONIACH I
4-2544
DRESCHER H
4-2527 4-2574
DUGGAN E L
4-2596
DUKELSKII V M
4-2726
DUMOND J W M
4-2686
DURYEE W R
4-2518
DZHELEPOV B S
4-2803

EDWARDS L D
4-2598
EIG L S
4-2693
ELGHAMMER R M
4-2541
ELLIOT H
4-2690
ELMORE W C
4-2760
EMELEUS H J
4-2642
ENDO S
4-2804
EVANS R D
4-2521 4-2816
EWALD V H
4-2723

FAGER E W
4-2643
FARBER R J
4-2754
FARMER F T
4-2510
FARRAR M W
4-2640
FASS H
4-2515
FEENBERG E
4-2766
FEINBERG E L
4-2695
FEITELBERG S
4-2554
FINLAY W L
4-2675
FIRSOV O B
4-2832 4-2842
FITZGERALD P J
4-2599
FLESHMAN W S
4-2666
FLOCK E V
4-2623
FONES W S
4-2655
FOOTE F W JR
4-2599
FORBES G B
4-2600
FORSTER H H
4-2691